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Eighteenth Annual Report

OF THE

North Dakota Agricultural Experiment Station

Agricultural College, North Dakota

TO

The Governor of North Dakota

1908

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LETTER OF TRANSMITTAL.

Agricultural College, N. D. February 1st, 1908.

HON. JOHN BURKE, GOVERNOR OF THE STATE OF NORTH DAKOTA.

SIR: As required by Act of Congress, approved March 2, 1887, I hereby submit the Eighteenth Annual Report of the North Dakota Experiment Station for the year ending February 1st, 1908, together with a financial statement of receipts and disbursements, as required by law, for the government fiscal year ending June 30th, 1907.

Very respectfully yours,

GEO. H. HOLLISTER,

Pres. Board of Trustees.

REPORT

To the Board of Trustees of the North Dakota Agricultural College and Experiment Station:

GENTLEMEN: I have the honor to submit herewith the Eighteenth Annual Report of the North Dakota Government Experimental Station.

The following bulletins were published during the year:

No. 75	Cereal Crop Experiments.....	J. H. Sheppard. O. O. Churchill.
No. 76	Experiments with Indian Corn in Forage Crops, Leguminous Crops,	J. H. Sheppard. O. O. Churchill.
No. 77	Bovine Tuberculosis	Dr. L. Van Es.
No. 78	Poultry Experiments Care and Management of the Flock	J. H. Sheppard. O. W. Dynes.

PRESS BULLETINS.

The following Press Bulletins were published during the year:

No. 23	Resistant Seed Flax and How to Get it	Henry L. Bolley.
No. 24	Preserving Eggs	E. F. Ladd
No. 25	Types of Spraying Apparatus and Machines which are Essential for Weed Extinction by Means of Chemical Sprays	Henry L. Bolley.
No. 26	Means of Eradicating Dandelions on Parks, Roadsides and Meadows	Henry L. Bolley.

No. 27	On the use of Chemical Sprays in Destroying Mustard and Other Weeds in Cereal Grain Fields	Henry L. Bolley.
No. 28	Canada Thistle: Means of Holding in Control	Henry L. Bolley.
No. 29	Quack Grass: How to Hold in Check	Henry L. Bolley.

THE WORK IN GENERAL.

A careful perusal of the work accomplished by the several members of the Station staff for the year ending February 1st, 1908, is conclusive evidence of its progressive character. With the funds available lines of investigation have been pursued best calculated to meet the agricultural conditions of the state. Farmers as a rule are adopting the recommendations made for their guidance, thru bulletins and newspaper articles, and numerous letters asking for information relative to destruction of weeds, rotation of crops, improved varieties of seed grain, methods of tillage, forestry and fruit trees, diseases of livestock, etc., occupy a considerable portion of the Station men's time. The new division of poultry breeding is attracting considerable attention. Bulletin No. 78 relating to poultry experiments was the subject of special demand from hundreds of actual and prospective poultry and egg producers in this and other states.

It is the purpose of the Station to enlarge and popularize this important branch of farm economics.

DAIRYING.

The dairy industry is making steady growth in the state. The dairy cow is destined to play an important part in the future prosperity of the commonwealth, both from the view point of conserving soil fertility and insuring the farmer a steady and regular income. To meet this growing demand for information and for practical creamery operators the Experiment Station should materially enlarge its facilities for making investigations and for giving instructions and practical training that will enable young men to engage in this important industry. This will require a new and properly equipped dairy laboratory which will cost not less than $25,000, or $30,000. An appropriation for this purpose will be asked of the Legislative Assembly of 1909.

VETERINARY LABORATORY.

The alarming spread of glanders in horses and tuberculosis in cattle makes it imperative that active steps be taken to eradicate these diseases and to fortify our farmers and stockmen against future contagion of their livestock. Swamp fever and other diseases also should be investigated and the whole subject of stock-raising studied as a branch of education having a material bearing upon the future prosperity of the state. Education and research along this line will return to the taxpayers a heavy per cent on the investment as well as encourage more rational educational ideals for those whose chief business is production.

A laboratory suitable for the purpose of offering instruction and for making investigations in animal husbandry—the diseases most prevalent and how to combat them, or better still how to prevent them—will cost in the neighborhood of $30,000. The next Legislative Assembly will be asked for an appropriation to construct and equip such a building.

J. H. Worst,
Director.

AGRICULTURAL DEPARTMENT

To Director J. H. Worst:

Sir: The work of the Agricultural Department has covered a slightly wider range during the past year than it has done heretofore.

Correspondence upon questions of farm management and improved strains of grain has been unusually heavy and the time which the writer has spent in supervising work has increased. Selecting and arranging for the Williston Sub-Station Farm required three trips to Williston for inspection and counsel. Inspection trips to the Edgeley and Dickinson Sub-Stations and to represent the institution at the Dry Land Farmers' meeting at Manhattan, Kansas, have been features of the year's work which account for a portion of my time and energy.

The Assistant Animal Husbandman and the writer have spent considerable time upon fairs and with the Live Stock Breeder's Association during the past year as a means of popularizing the work and of gaining support for it.

High prices for grain and lower market for live stock has brought out a strong tendency to sacrifice the live stock of the state and it has seemed to me that efforts spent to prevent that result have been well worth the time they require.

During the past year three bulletins have been written by this department. Number 75 entitled "Cereal Crop Experiments" is a complete report to date of the Station's field trials with cereals and summarizes the data recorded during a period of sixteen years. It gives the records made by the best pedigreed seeds, which have been bred up by the Station, many of which show almost incredible improvement in yielding capacity and far outdo the old standard sorts of the country. A bulletin now in the hands of the printer shows the wide distribution which these improved sorts have received and the consequent added value to the state's annual production. No. 388, Tartarian oats for example, outyielding the standard White Russian strain of the country 2.6 bushels per acre as an average for four years. The oat area in North Dakota in 1905 was 1,076,970 acres; therefore, the use of this improved seed would add 2,800,122 bushels to the annual oat yield, which would at this season's price represent a million dollars added value. Improved

flax, barley, wheat and corn have been distributed which have similarly added to the crop production of the state and leave no doubt of the value of the results obtained.

Bulletin No. 76 "Experiments with Indian Corn, Forage Crops, Leguminous Crops" gives a summary of the results recorded in sixteen years' trials with these crops. Bulletin No. 78 "Poultry Experiments, Care and Management of the Flock" has been in strong demand by poultry men and is evidently proving of service to our poultry owners.

A car load of steers were fed out in two lots in a comparision of barley with corn; bran being used in the proportion of one to three by weight with each as a food to balance the ration. Hogs followed the steers and give a record of the residual value of the droppings for pork production.

The cost of milk production is receiving systematic study. The feed given and the milk secured are weighed for each cow throughout the year. The live weight of the cow and the percentage of fat in the milk are all recorded regularly so that when sufficient data shall have accumulated the answer to questions concerning the cost of milk production under North Dakota conditions can be answered.

Several steers have been fitted for fairs and fat stock shows for demonstration and to stimulate interest in such enterprises.

Fattening hogs on corn compared with barley—shorts being used as a supplementary feed in each case—has been carried on and the data recorded.

"Hogging off" field peas has also been investigated by comparing the gains made by a lot of hogs thus pastured with a similar lot receiving barley and shorts alone and having a dry yard for a run way. A number of special pens of hogs have been fattened for fairs and shows.

Some special problems in cross-breeding have been studied and the effect upon the form, size and thrift of the resulting litters has been made a matter of record.

Two lots of lambs are now upon a feeding trial; the one receiving barley and the other emmer, as a fattening ration. The sheep producers of the state are much interested in the feeding value of spelt and are desirous of information upon the subject.

The cost of egg production and the temperature and ventilation of poultry houses for best results in this climate are being studied. Breeding for high egg production is given encouraging results as two hundred egg hens have been produced and will be placed in the breeding pens for 1908. The effect of age upon the egg production is a practical trial under way. The effect of age and of chilling upon incubation is an interesting and practical study, which is being carried on. Natural and artificial incubation

comparisions are also features of the poultry trials. A caponizing experiment is under way and will be reported upon later.

Grade breeding trials with poultry are being carried on and several generations have been produced. These trials show the utter folly of failing to keep high grade fowls on the part of the poultry owners as three good sires in succession have given a standard type of the desired breed.

In and in breeding—a very common mistake is the practices of poultry growers is being studied to demonstrate the actual loss in egg production, size of the fowls and vitality of the flock, which this pernicious practice represents. Warm vs. cold housing and ranging compared with close yarding will be studied in relation to egg production.

The drainage system, for experiment, mentioned in my last annual report has been put into full working form for recording the observations which the trial will require. Tile wells have been placed at regular intervals over the field and the water table is being observed at the various points to note the effect which they will have upon lowering the water table in the soil. A silt well has also been inserted so that definite observations can be made and if possible a measure taken of the amount of water which passes through the system of drains. That they will draw water through the Red River Valley soil has already been proven by the steady flow which this drain kept up for several weeks while the water table was high enough to permit drainage to occur. Since the drain has been in place and the soil fully settled above it so that the system was ready for normal action, the weather has been so dry that there has been little chance for observations upon it.

The latteral drains are at a number of different depths which makes it possible to study the depth to saturated soil, adjacent to different depths of tile and midway between latterals laid at the same depth and at varying distances apart.

A small system of tile drains near the agricultural building of the Station is fitted up with a silt well and numerous observation wells in such a way as to supplement the observations which can be made on the forty acre trial system of drains.

The rotation of crop studies have been continued with little interruption and are recording data of great value in its bearing upon the farm management of the Northwest.

The cereal breeding nursery has been enlarged by the introduction of a number of trials in cross breeding oats and in crossing wheat and emmer. Red clover breeding has also been added to the nursery work.

Success in maturing ten year old seed of North Dakota No. 100 corn which had served as foundation stock for a strain that has

been bred in the nursery for a decade has given positive evidence of the kind of changes which have been made and of the degree of change which has occurred. The results are very encouraging as they indicate that an improvement in earliness of more than a day a year has been made and that changes in the type of equal degree have occurred as a result of the breeding work carried out.

Trials with clover of different sorts are in progress. Red and alsike strains are being given extended field trials and are showing good results in the form of successful crops.

Alfalfa trials are being continued and while they are not so certain of bringing returns as the red clover, the results are encouraging.

The trials with winter wheat and winter rye are giving results which indicate as rapid progress as could reasonably be expected. North Dakota Nos. 959 and 1134 winter rye are now improved until they are much hardier than the common sorts and will, I believe, prove hardy in our climate and serviceable to our grain growers.

Winter wheat breeding is a slower process, as it is naturally much less hardy than winter rye and hence does not so quickly respond to selection for hardiness.

The distribution of pedigreed seed bred up by the Station has continued. This season seed of the following sorts have been offered for distribution by sale:

North Dakota No. 388 Tartarian oats.
" " " 666 Sixty Day oats.
" " " 871 Mandscheuri Barley.
" " " 155 Flax.
" " " 959 Winter Rye.

Following is the report of the grain yields upon the farm for 1907:

Field	Crop	No. of Acres	Yield per A.	Total Bu.	Grand Total Bu.
NW¼	No. 788 oats	30.65	53	1633	
NW¼	No. 666 "	26.70	51.6	1379	
SW¼ of SW¼	No. 788 "	16.5	41.7	689	
SW¼	No. 788 "			275	3976
SE¼ of NW¼	No. 871 barley	40.0	36.0	1433	1433
SW¼ of NW¼	Potatoes	2.93	192.8	565	
SE¼ of SW¼	"	2.64	114.0	302	
SW¼	"	2.95	312.8	923	
SW¼ of SE¼	"	1.35	150	203	1993

Hay produced on other fields and stacked outside has not yet been weighed and hence only estimates could be given.

Fifty acres of North Dakota No. 950 or Golden Dent corn was made into ensilage during the first week in September and produced only about four tons per acre as the stand was poor and the season cold and unfavorable to this semi-tropical crop.

Following is the report upon the poultry plant for 1907.

EGG RECORD BY MONTHS.

January	291
February	832
March	1099
April	1815
May	1896
June	1440
July	1134
August	1159
September	997
October	475
November	175
December	91
	11404 or 950-1-3 doz.

EGGS SUPPLIED TO FARM HOUSE.

January—16½ doz. at 30 cts.	$ 4.95
February—63 doz. at 30 cts.	18.90
March—78 doz. at 25 cts.	19.80
April—78 doz. at 18 cts.	14.04
May—82 doz. at 15 cts.	12.30
June—71¾ doz. at 20 cts.	12.20
July—66¾ doz. at 20 cts.	13.35
August—60¾ doz. at 20 cts.	12.15
September—44½ doz. at 22 cts.	9.79
October—47½ doz. at 25 cts.	11.40
November—46½ doz. at 25 cts.	11.62
December—41 doz. at 30 cts.	12.30
	$ 152.80

UNDRESSED POULTRY SUPPLIED TO FARMHOUSE.

January—35 lbs. at 12 cts.	$	4.20
February—31½ lbs. at 12 cts.		3.78
May—34½ lbs. at 12 cts.		4.14
June—16 lbs. at 10 cts.		1.60
October—47½ lbs. at 10 cts.		4.75
November—95 lbs. at 10 cts.		9.50
December—84 lbs. at 10 cts.		8.40
353½ lbs.	$	36.37

EGGS TO DOMESTIC SCIENCE DEPARTMENT.

9 doz. at 15 cts.	$	1.35
2 doz. at 17 cts.		.34
	$	1.69

SALE OF BREEDING STOCK.

25 cockerels sold for	$	35.50

SALE OF MARKET EGGS.

50 doz. at 15 cts.	$	7.50

INVENTORY JANUARY 1, 1908.

Kind of Stock	R. C. B. Leg	B. P. Rocks	Grade	Butcher Stock	Total
Pullets	6	84	10	30	130
Hens	20	38	17	....	75
Males	5	15	....	15	35
Totals	31	137	27	45	240

SUMMARY.

Eggs suppplied to farmhouse	$	152.80
Poultry for farmhouse		36.37
Eggs to Domestic Science Department		1.69
Sale of Breeding Stock		35.50
Sale of Market Eggs		7.50
Total	$	233.86

NEEDS OF THE DEPARTMENT.

A suitable dairy building and dairy barn are badly needed by the Department. The present dairy plant is inadequate in size and so dadly decayed as to constitute a poor makeshift for its purpose. A building commensurate with our needs would with its equipment cost $40,000. Great difficulty has been experienced in securing fresh milk for the work of the dairy and I see no remedy for the difficulty except to supply our own cows. To carry a dairy herd it would be necessary to build a barn for housing them and I anticipate that the cost of a suitable structure would be $10,000.

Steer and sheep feeding barns and equipment are badly needed for the prosecution of that important line of study and I would recommend an appropriation of five thousand dollars ($5,000.00) for that purpose. The fact that much of the crop producing area of the state will yield as much small grain and grow a crop of corn every fourth year as it does when fallowed or when no change is made from small grain cropping raises the question of the economic value of this great increasing quantity of provender and the best means of turning it into marketable form by feeding it to live stock. Since the screenings and bran and shorts grown annually in this state would fatten all of the live stock grown on our vast ranges, a study of the most economic use of these products in feeding live stock is of vast importance. More or less of unmarketable and cheap grain is produced each year which is wasted if not consumed by farm animals and which will add another source of income if means for its economic use can be devised.

My thanks are due and hereby tendered to the following young men who have assisted me in carrying the work during the past year for which this Department has been held responsible: Assistant O. O. Churchill has carried large responsibility in the plant breeding nursery and field crop work now under trial; Assistant W. B. Richards has taken the responsibility for the detail of the animal husbandry work; Assistant Oliver Dynes has given much aid in the poultry trials which have been undertaken and has rendered efficient service; E. G. Schollander has carried the work of the Demonstration Farms with little of counciling since their location was decided upon and the plan of rotation arranged. His work throughout the season has been commendable; Assistant R. M. Dolve has carried the detail of the work in the tile drainage experiments; C. M. Hennis has carried out the detail of the work required of the farm foreman in an efficient, conscientious manner and relieved the writer of much detail of the farm work and management.

Respectfully submitted,

J. H. SHEPPERD,
Agriculturist.

CHEMICAL DEPARTMENT

To J. H. Worst, Director:

Sir: I herewith present my Eighteenth Annual Report as Chemist of the North Dakota Government Agricultural Experiment Station covering the calendar year 1907.

The work in the Chemical Department during the past year has covered a wide range of subjects, and especially since it has been made the duty of the Department to see that the several laws pretaining to foods, drugs, stock foods, formaldehyde, paris-green, fertilizers, etc., are properly enforced.

The principal investigations have been in the study of the soils of the state with special reference to the composition of the humus content, to the availability of plant food in the soils, and to the changes which have taken place through continuous cropping with wheat. For this work samples of soil have been secured from various parts of the state, and especially from the demonstration farms, which are distributed throughout the state. For this particular line of soil work there has been added to the force of the Department one Chemist, who will devote his entire time to the study of soils.

A further line of investigation undertaken has been the study of wheats to determine their milling qualities, bread-making qualities, chemical composition, the relation of the gliadin and gluten contents to the baking quality, and the study of the structure of the wheat kernel in relation to its milling qualities. There has been under investigation, further, durum wheats to determine their relative value for flour production and for bread-making. For this purpose the durum wheats grown in different parts of the state, where climatic and soil conditions are different, have been gathered and carefully studied.

The last session of the Legislature appropriated $6,500 to be used in the construction of a building wherein milling investigations and wheat studies may be further carried on. This building has, during the past summer, been erected; and in addition to the mill proper, which extends through three stories in height, there are attached four laboratories and flour testing rooms. The flour mill consists of three sets of double rollers, and is probably the best equipped experimental mill in this country. A competent miller

has been employed, one who for several years has had charge of one of the large flour mills in Minnesota and, therefore, wholly competent to carry on the work, such as is desired in the study of wheats.

There has also been conducted during the past year a very extensive series of experiments in the study of paints. There have been erected for experimental purposes four test fences where paints, produced especially for this work, have been under test, also commercial paints as found upon the market, together with various white leads and substitute compounds. A number of buildings have also been experimentally painted with various combinations of paints to study the effect upon the buildings, both for the first painting and the re-painting. The funds which enabled us to undertake this line of experiments were in a large measure furnished by the Paint Grinder's Association of the U. S. A., and by the National White Lead Company.

In most of the investigations now in progress it is too early to draw definite conclusions with regard to the practical or scientific value of the results. It is our purpose to continue the experiments during the next two years or more in order to determine the value of the experiments now being made.

There have been examined during the year, in addition to the foregoing, 177 samples of water, sent in by the farmers of the state; 102 samples of formaldehyde, nearly 250 analyses of paints, oils and varnish products, over 3,000 samples of food and drug preparations, 250 samples of whiskies and other beverages, a large number of cattle foods and other agricultural products.

The correspondence for the year has been exceptionally large, and there has been written 5,204 personal letters, in addition to a large number of circular letters, postal cards and bulletins, which have been sent out in reply to other letters received by the department.

Part II of the present report includes the results of investigations made under the Pure Food Law, the Drug Law, the Patent Medicine Law, and in part the experiments as made under the Paint Law. The results of experiments now in progress with the wheat investigation will be issued as a separate bulletin, as will also the results of the practical paint tests which were begun two years ago and continued through the present year.

SUMMARIES OF TEMPERATURE AND RAINFALL.

Meteorological records of this Station have been maintained since the opening of the Station seventeen years ago. The data for each year has been published in preceding Annual Reports, and for the present year we have the following data:

TEMPERATURE AND RAINFALL FOR 1907.

Month	Mean.	Maximum	Mean of Maxima	Minimum	Mean of Minima	Rainfall in Inches
January	3.39	35	6.81	-27	-13.15	.34
February	9.73	40	19.18	36	0.21	.08
March	23.45	62	33.27	-6	13.57	.10
April	32.6	65	41.3	11	23.9	.08
May	43.68	77	55.54	18	32.96	1.37
June	62.33	87	73.76	37	52.1	3.12
July	67.52	90	79.16	47	56.4	2.39
August	65.42	95	77.00	38	54.39	2.84
September	56.68*	76	63.36	35*	45.36*	3.90
October	41.04**	77	57.00	15**	27.41**	.84
November	28.67	53	39.23	1	19.03	.13
December	19.42	45	28.45	-16	10.39	.15
Means & totals	37.26		48.02		26.85	15.34

* The record of the minimum temperature for the last 8 days of the month was lost, owing to the breaking of the instrument, and, therefore, the mean and the minimum records for the month are deficient for these days.

** Record lost for first seven days of the month.

The mean annual temperature for a number of years preceding 1906 averaged 39.40°. In 1906, however, the average was quite a little above the mean being 47.3° at this Station. It will be observed that the mean temperature for 1907 is quite a little below the general average, or 37.26°.

Summarizing our results for temperature we have:

Mean of temperature for 1906	47.3
Mean of temperature for 1907	37.26
Mean of maxima temperature 1907	48.02
Mean of minima temperature 1907	26.85
Maximum temperature registered August 10th	95.00
Minimum temperature registered February 4th	-36.0
Range of temperature for 1907	131°

The rainfall for 1907 was 15.34 inches as compared with 17.70 inches for 1906, and 30.76 inches for 1905. The average for the past fifteen years, preceding the present, has been 21.36 inches. It will thus be observed that the excessive rainfall for the past few years has given place to a rainfall below the average.

The annual rainfall by years since 1892 is shown in the following:

	1892	1893	1894	1895	1896
Rainfall, inches	20.73	16.17	18.72	16.05	21.77
	1897	1898	1899	1900	1901
Rainfall, inches	22.50	16.36	21.20	25.54	25.68

.....	1902	1903	1904	1905	1906	1907
Rainfall, inches	23.16	23.81	20.26	30.76	17.70	15.34

In other words, the average rainfall at this Station, during the past year, has been less than for any preceding year of the sixteen years of record. The average rainfall for the sixteen years has been 20.98; the minimum, 15.34, and the maximum, 30.76. Thus giving in 1905 the highest rainfall, and in 1907 the lowest rainfall for the period.

MONTHLY RECORD OF SUNSHINE.

As in the past, the record of the sunshine has been taken by means of a Friez Photographic Record, but no correction has been made for early morning and evening sunshine, which has been estimated to amount to approximately 12% more than the recorded sunshine. Unfortunately, the record for the month of August was destroyed.

SUNSHINE RECORD 1907.

	Total Hours		Hours of Daily Means		Percentage of Possible Sunshine
	Possible	Recorded	Possible	Recorded	
January	279.10	91.4	9.00	2.95	32.51
February	287.10	141.9	10.25	5.06	49.58
March	369.00	159.6	11.90	5.14	43.59
April	40.73	143.2	13.50	4.77	34.83
May	456.30	187.6	14.71	6.05	40.73
June	475.00	236.0	15.83	7.86	49.60
July	480.20	258.4	15.49	8.33	53.80
August	441.80	Lost	14.25	Lost	Lost
September	378.30	180.8	12.60	6.02	47.54
October	337.60	165.8	10.89	5.35	49.06
November	281.60	117.3	9.38	3.91	41.61
December	267.10	8.6	8.61	2.63	30.44
Means	341.15	153.6	12.20	5.27	43.32

The mean record as given above are for the 11 months, and therefore, not wholly comparable with that of previous years.

RECORD OF WIND VELOCITY.

As in the past the record for the wind velocity is that as recorded by a Friez Wind Gage and Anemometer Register. Unfortunately there have been several breaks in the records during the year, owing to the bad connections in the electrical appliances, and neces-

	JANUARY*			FEBRUARY**		
	Total Miles	Mean Velocity	Maximum Vel.	Total Miles	Mean Velocity	Max. Vel
1.	Lost	Lost	Lost	Lost	Lost	Lost
2.	Lost	Lost	Lost	699	29.1	34
3.	369	15.4	26	161	6.7	9
4.	449	18.7	30	148	6.1	15
5.	480	20.0	26	329	13.7	22
6.	201	8.3	18	325	13.5	19
7.	280	11.6	20	239	9.9	20
8.	362	15.0	22	269	11.2	12
9.	424	17.7	27	403	16.7	36
10.	230	9.5	24	370	15.4	25
11.	256	10.6	24	322	13.4	27
12.	362	15.0	15	341	14.2	42
13.	353	14.7	23	471	19.6	46
14.	363	15.1	22	263	10.9	23
15.	183	7.6	13	291	12.1	17
16.	168	7.0	10	191	7.9	15
17.	137	5.7	11	343	14.2	38
18.	421	17.5	37	417	17.3	36
19.	640	26.6	43	364	15.1	27
20.	362	15.0	20	322	13.4	22
21.	363	15.1	23	143	5.9	26
22.	244	10.1	30	497	20.7	37
23.	490	20.4	32	Lost	Lost	Lost
24.	463	19.1	29	Lost	Lost	Lost
25.	342	14.2	19	432	18.0	40
26.	319	13.2	20	734	30.5	32
27.	Lost	Lost	Lost	196	8.1	16
28.	Lost	Lost	Lost	354	18.0	20
29.	Lost	Lost	Lost	Lost	Lost	
31.	Lost	Lost	Lost			
30.	Lost	Lost	Lost			
Means & Totals	8261	14.25	23.91	9224	14.46	26.25

* Record for seven days lost in January.
** Three days lost in February.

	MARCH*			APRIL		
	Total Miles	Mean Velocity	Maximum Vel.	Total Miles	Mean Velocity	Max. Vel
1.	352	14.6	18	327	13.6	39
2.	218	9.0	12	724	30.1	40
3.	205	8.5	14	422	17.5	22
4.	365	15.2	23	329	13.7	30
5.	253	10.5	36	467	19.4	25
6.	596	24.8	34	484	20.1	30
7.	396	16.5	19	561	23.3	30
8.	197	8.2	19	490	20.4	44
9.	373	15.5	24	689	28.7	31
10.	296	12.3	23	394	16.4	26
11.	497	20.7	32	416	17.3	37
12.	450	18.7	24	713	29.7	43
13.	225	9.3	21	741	30.8	36
14.	282	11.7	23	345	14.3	26
15.	Lost	Lost	Lost	507	21.1	43
16.	Lost	Lost	Lost	868	36.1	41
17.	315	13.1	33	539	22.4	24
18.	509	21.2	33	178	7.4	13
19.	418	17.4	36	182	7.5	18
20.	611	25.4	30	393	16.3	28
21.	Lost	Lost	Lost	243	10.1	34
22.	348	14.5	20	546	22.7	42
23.	203	8.4	35	216	9.0	19
24.	522	21.7	36	312	13.0	24
25.	626	26.0	34	375	15.6	30
26.	367	14.8	33	209	8.7	17
27.	603	25.1	29	412	17.1	35
28.	265	11.0	43	322	13.4	16
29.	592	24.6	41	193	8.0	37
30.	506	21.0	18	470	19.6	36
31.						
Means & Totals	11590	16.28	27.51	13067	18.44	30.2

* Records lost for three days in March.

	MAY			JUNE*		
	Total Miles	Mean Velocity	Maximum Vel.	Total Miles	Mean Velocity	Max. Vel.
1.	430	17.9	36	241	10.0	20
2.	352	14.6	19	364	15.1	21
3.	214	8.9	28	236	9.8	26
4.	444	18.5	26	383	15.9	29
5.	305	12.7	29	134	5.5	20
6.	437	18.2	22	356	14.8	23
7.	184	7.7	26	Lost	Lost	Lost
8.	366	15.2	34	Lost	Lost	Lost
9.	590	24.3	26	368	15.3	20
10.	268	11.1	33	352	14.6	23
11.	588	24.5	40	348	14.5	18
12.	505	21.0	40	214	8.9	20
13.	906	29.4	30	393	16.3	30
14.	529	22.0	35	406	16.9	32
15.	417	17.2	24	593	24.7	33
16.	289	12.0	18	481	20.0	28
17.	315	11.8	29	275	11.4	22
18.	442	18.4	31	328	13.6	18
19.	435	18.1	23	159	6.6	22
20.	161	6.7	25	405	16.8	27
21.	359	14.9	28	472	18.6	29
22.	140	5.8	14	135	5.6	7
23.	324	13.5	22	224	9.3	19
24.	313	13.0	23	268	11.1	35
25.	479	19.9	35	335	13.9	34
26.	683	28.4	35	171	7.1	14
27.	296	12.3	29	324	13.5	22
28.	459	19.1	30	378	15.7	28
29.	261	10.8	19	134	5.5	31
30.	249	10.3	12	307	12.7	23
31.	107	4.4	11			
Means& Totals	11674	15.56	26.83	8784	12.27	24.06

	JULY			AUGUST		
	Total Miles	Mean Velocity	Maximum Vel.	Total Miles	Mean Velocity	Max. Vel.
1.	187	7.7	20	436	18.1	29
2.	296	12.3	18	232	9.7	16
3.	224	9.3	25	213	8.8	21
4.	363	15.1	23	362	15.0	16
5.	293	12.2	21	324	13.5	14
6.	189	7.8	14	271	11.2	18
7.	282	11.7	17	257	10.7	20
8.	263	10.9	20	311	12.9	20
9.	116	4.8	8	357	14.8	31
10.	120	5.0	10	421	17.5	31
11.	169	7.0	18	487	20.2	39
12.	370	15.4	22	186	7.7	13
13.	297	12.3	24	236	9.8	28
14.	236	9.8	10	457	19.0	33
15.	140	3.8	17	463	19.2	35
16.	299	12.4	15	507	21.1	35
17.	233	9.7	14	394	16.4	26
18.	188	7.8	17	416	17.3	26
19.	200	8.3	15	377	15.7	21
20.	230	9.5	18	230	9.5	16
21.	234	9.7	18	197	8.2	20
22.	155	6.4	21	505	21.0	36
23.	334	13.9	23	406	16.9	33
24.	161	6.8	27	355	14.7	23
25.	392	16.3	27	270	11.2	23
26.	162	6.7	28	287	11.9	19
27.	433	18.0	28	171	7.1	11
28.	283	11.8	15	209	8.7	16
29.	167	6.9	11	163	6.7	14
30.	222	9.2	15	380	15.8	26
31.	213	8.8	28	362	15.0	14
Means& Totals	7451	9.91	18.93	10262	13.71	23.32

	SEPTEMBER			OCTOBER		
	Total Miles	Mean Velocity	Maximum Vel.	Total Miles	Mean Velocity	Max. Vel.
1.	263	10.9	17	414	17.2	27
2.	267	11.1	16	268	11.1	19
3.	254	10.5	19	276	11.5	16
4.	161	6.7	15	240	10.0	14
5.	253	10.5	18	278	11.5	18
6.	233	9.7	15	273	11.2	28
7.	266	11.0	21	416	17.3	26
8.	176	7.3	20	468	19.5	29
9.	236	9.8	20	487	20.2	20
10.	185	7.7	19	413	17.2	32
11.	189	7.8	20	374	15.5	23
12.	367	15.2	26	173	7.2	12
13.	262	10.9	19	460	19.1	25
14.	133	15.5	13	236	9.8	12
15.	255	10.5	19	217	9.0	19
16.	210	9.7	16	297	12.3	36
17.	316	13.1	18	513	21.3	36
18.	289	12.0	21	Lost	Lost	Lost
19.	394	16.4	29	Lost	Lost	Lost
20.	391	16.2	33	180	7.5	28
21.	430	17.9	33	430	17.9	27
22.	414	17.2	29	Lost	Lost	Lost
23.	565	23.5	33	Lost	Lost	Lost
24.	402	16.7	20	300	12.5	26
25.	423	17.6	17	104	4.3	26
26.	303	12.6	17	Lost	Lost	Lost
27.	154	6.4	17	Lost	Lost	Lost
28.	308	12.8	19	Lost	Lost	Lost
29.	213	8.8	13	302	12.5	24
30.	205	8.5	25	382	15.8	24
31.				478	19.9	26
Means& Totals	8517	12.11	20.56	7979	13.80	24.29

	NOVEMBER			DECEMBER		
	Total Miles	Mean Velocity	Maximum Vel.	Total Miles	Mean Velocity	Max. Vel.
1.	333	13.8	21	274	11.4	17
2.	246	10.2	22	339	14.1	27
3.	296	12.3	18	344	14.3	30
4.	189	7.9	27	523	21.7	30
5.	380	15.8	22	359	14.9	19
6.	204	8.5	28	258	10.7	17
7.	464	19.3	29	194	8.0	10
8.	414	17.2	30	262	10.9	32
9.	362	15.0	29	497	20.7	23
10.	559	23.2	27	248	10.3	17
11.	259	10.7	28	308	12.8	17
12.	474	19.7	34	385	16.0	20
13.	445	18.5	21	394	16.4	18
14.	264	11.0	20	179	7.4	8
15.	313	13.0	19	234	9.7	19
16.	303	12.6	25	298	12.4	17
17.	346	14.4	17	180	7.5	18
18.	231	9.6	18	318	13.2	18
19.	571	22.7	28	321	13.3	15
20.	422	17.5	22	172	7.1	25
21.	330	13.7	16	456	19.0	24
22.	313	13.0	20	351	14.6	28
23.	365	15.2	18	Lost	Lost	Lost
24.	313	13.0	22	Lost	Lost	Lost
25.	216	9.0	13	348	14.5	24
26.	265	11.0	32	405	16.8	30
27.	454	18.9	32	373	15.5	18
28.	326	13.5	20	332	13.4	18
29.	325	13.5	24	346	14.4	25
30.	227	9.4	13	293	12.2	22
31.				120	5.0	13
Means& Totals	10209	13.77	23.16	9111	13.04	24.40

The total number of miles recorded for the year ending December 31st, have been as follows:

January	8,261	*
February	9,224	**
March	11,590	***
April	13,067	
May	11,647	
June	8,784	****
July	7,451	
August	10,262	
September	8,517	
October	7,979	*****
November	10,209	
December	9,111	******
Total	116,102	

* Six days records were lost for January.
** Records of four days for February were lost.
*** During the month of March 2 days records were lost.
**** Two days records for June were lost.
***** For month of October five days records were lost.
****** For month of December records for two days were lost.

For the 344 days record the velocity averaged 337 miles per day, or 14 miles per hour. At the same rate for the 21 days unrecorded the total miles for the year would be 123,169 miles.

EVAPORATION FROM WATER SURFACE.

For the past six seasons there has been kept a record showing the daily evaporation of water from a water surface for the principal growing months. This work is carried on in connection with the soil experiments and the study of plant nutrition for the purpose of gaining information with regard to the movement of water in the soil.

A galvanized iron tank, three feet square by 14 inches in depth, painted black, contained a second smaller tank, 12x12x12 inches in dimensions, likewise painted black. These tanks were sunk in a grass plot, even with the surface of the ground. The small tank contained distilled water, and this tank set within the larger tank was surrounded with water. Daily measurements were made of the amount of evaporation, and the tank kept at a uniform level by the frequent addition of distilled water.

The following table shows the amount of water evaporated daily, expressed in inches:

Date	May	June	July	August	September	October
1	.02	.15	.10	.02	.10	.24
2	.00	.30	.15	.14	.10	.05
3	.03	.05	.27	.16	.15	.04
4	.00	.33	.09	.07	.07	.06
5	.20	.20	.12	.12	.08	.10
6	.10	.04	.17	.11	.04	.04
7	.20	.15	.21	.10	.00	.00
8	.30	.10	.25	.18	.08	.10
9	.20	.08	.11	.07	.10	.10
10	.30	.16	.05	.15	.10	.05
11	.10	.00	.25	.20	.10	.05
12	.20	.20	.20	.20	.08	.05
13	.00	.20	.31	.12	.12	.05
14	.00	.15	.20	.13	.00	.10
15	.20	.20	.23	.37	.11	.10
16	.10	.23	.27	.00	.00	.10
17	.20	.17	.12	.25	.06	.08
18	.30	.17	.10	.07	.20	.05
19	.20	.16	.10	.08	.10	.07
20	.21	.17	.20	.22	.10	.06
21	.00	.20	.10	.08	.10	.06
22	.25	.05	.20	.08	.08	.08
23	.25	.25	.02	.12	.10	.00
24	.15	.02	.10	.20	.02	.10
25	.00	.28	.25	.10	.20	.10
26	.20	.20	.15	.10	.06	.10
27	.30	.30	.12	.12	.05	.10
28	.20	.20	.20	.08	.08	.06
29	.10	.11	.10	.00	.02	.00
30	.02	.20	.20	.06	.06	.01
31	.20	—	.02	.10	—	.00
Total	4.53	5.02	4.96	3.70	2.46	2.10
Mean	.14	.16	.16	.12	.08	.07

The total amount of water evaporated from a water surface for the five months, May, June, July, August and September, was 20.67 inches; a monthly average of 4.135 inches, or a daily average of .135 inches. This evaporation is even less than for the preceding years.

A summary for the past five years is shown by months in the following table:

INCHES OF EVAPORATION

Month	1902	1903	1904	1905	1906	1907
May	6.48	4.30	6.40	4.37	3.63	4.53
June	5.75	8.69	5.40	5.60	3.57	5.02
July	4.77	13.26	8.05	6.67	5.84	4.96
August	6.62	12.07	8.30	6.51	5.21	3.70
September	4.50	3.55	2.29	3.28	4.11	2.46
Total	28.12	41.87	30.44	26.43	22.36	20.67

For the six years there is shown a very wide range. The evaporation for the past year has been the lowest for the entire period. When this data is examined in connection with other meteorological data, especially with sunshine and relative humidity of atmosphere, there is offered much instructive information and gives us some clue as to the probable movement of soil moisture.

The rain-fall for the same period has been as follows:

INCHES OF RAIN-FALL

Month	1902	1903	1904	1905	1906	1907
May	4.25	2.78	1.47	5.77	3.03	1.57
June	3.97	.56	3.83	5.00	3.11	3.12
July	2.54	2.62	2.83	5.17	2.68	2.39
August	2.95	4.61	.69	6.82	2.22	2.84
September	1.61	5.61	3.49	3.47	1.18	3.90
Total	14.32	16.18	12.30	26.23	12.22	13.82

It is interesting to note the difference in rainfall as compared with evaporation for the several years, which is indicated by the following:

EVAPORATION TIMES THE RAINFALL

1902	1.96
1903	2.58
1904	2.47
1905	1.003
1906	1.829
1907	1.489

There is shown a very wide range during the past six years and in order to understand the low evaporation for the past year it is necessary to take into consideration the matter of sunshine and temperature, which for 1907 have been abnormal during the months indicated.

ANALYSIS OF FORMALDEHYDE.

The Ninth Legislative Assembly of North Dakota, in 1905, enacted a Formaldehyde Law making it necessary for manufacturers or jobbers of formaldehyde, doing business in North Dakota, to first procure a license for the sale of formaldehyde from the Experiment Station. The manufacturers or jobbers must deposit with the Station a sample of their formaldehyde, setting forth the strength of the same, and this sample shall be considered as constituting a guarantee to the purchaser. Every sample of formaldehyde sold or offered for sale in the state as a fungicide should contain at least 40% by weight of formaldehyde. If it falls below 38%, it shall be deemed to be adulterated. It is made the duty of the Experiment Station to see that this law is enforced, and the work has devolved upon the Chemical Department.

During the past year some of the formaldehyde sold in the state contained an unusually large amount of methyl alcohol, and it is a question whether the presence of so much alcohol does not prove a detriment, in as much as it is likely to prove injurious to the grain. The presence of the methyl alcohol has a tendency to prevent the polymerization, but the alcohol is also a hardening agent, and, from complaints which have been made regarding the use of formaldehyde, it would seem possible that some of the difficulty may be due to a too large a proportion of wood alcohol. Experiments should be made at an early date to determine the effect of different proportions of methyl alcohol and other constituents which are known ingredients of the commercial aldehyde as found upon the market.

During the past year 102 samples of formaldehyde were analyzed:

Lab. No.	CONTRIBUTORS AND THEIR ADDRESSES.	Percent
591	Dr. Lowe Formaldehyde Co., Chicago, Ill.	40.72
592	Jewett Drug Co., Aberdeen, S. D.	41.23
593	Eliel-Jerman Co., Minneapolis, Minn.	39.72
594	International Drug Co., Sherwood, N. D.	38.80
595	L. W. Leithhead Drug Co., Duluth, Minn.	40.63
596	J. J. Flaherty, Linton, N. D.	39.93
597	A. S. Blakey, Minot, N. D.	39.93

598	Pingree Drug Co., Pingree, N. D.	38.53
599	N. E. McGruer, Langdon, N. D.	39.38
600	Stehler & Lambert, Foxholm, N. D.	39.40
601	S. L. Harris, Oakes, N. D.	39.43
602	Dr. H. Bacharach, Finley, N. D.	40.38
603	R. B. Kilbourn, Bottineau, N. D.	39.49
604	Noyes Bros. & Cutler, St. Paul, Minn.	39.50
605	Great Bend Pharmacy, Great Bend, N. D.	40.05
606	Johnson & Ballideau, Mohall, N. D.	40.16
607	B. Romanson & Co., Souris, N. D.	40.83
608	B. Romanson & Co., Souris, N. D.	39.48
609	Davidson & Eng, Lawton, N. D.	40.05
610	W. O. DePuy & Co., Rolla, N. D.	40.05
611	Devils Lake Drug Co., Devils Lake, N. D.	40.16
612	Vorachek Drug Co., Lankin, N. D.	38.42
613	Vorachek Drug Co., Lankin, N. D.	40.05
614	O. E. Holmes, Kensal, N. D.	39.38
615	O. E. Holmes, Kensal, N. D.	39.26
616	Dakota Drug Co., Valley City, N. D.	40.06
617	Amos Abbott & Co., Langdon, N. D.	39.94
618	Minot Drug Co., Minot, N. D.	39.98
619	Greatbend Pharmacy, Greatbend, N. D.	40.04
620	Jacob Stockland, Angie, N. D.	38.25
621	Williston Drug Co., Williston, N. D.	39.37
622	Harvey Drug Co., Harvey, N. D.	40.50
623	Stewart-Mott Drug Co., Sarles, N. D.	39.03
624	Busch Bros., Underwood, N. D.	39.26
625	Johnson & Co., Cando, N. D.	38.17
626	Jos. Pazendak, Fullerton, N. D.	39.50
627	Clarke Drug Co., Mandan, N. D.	39.38
628	S. E. Arthur, York, N. Y.	41.62
629	Fout & Porterfield, Fargo, N. D.	39.98
630	Benj. Tverson, Tioga, N. D.	38.70
631	L. D. Carlson, Lansford, N. D.	39.71
632	D. S. Beystad, Bowbells, N. D.	40.50
633	Barton Drug Co., Barton, N. D.	40.73
634	Chas. O. Dahlstrom, Balfour, N. D.	38.92
635	Chatz Pharmacy, Goodrich, N. D.	38.10
636	Oscar Zuercher, Berwick, N. D.	41.62
637	J. M. Cobbison, Minnewaukan, N. D.	39.82
639	G. T. Knudson, Dazey, N. D.	39.38
640	Jens J. Jensen, Larimore, N. D.	39.03
641	J. J. Pool, Perth, N. D.	39.37
642	J. J. Pool, Perth, N. D.	39.82
643	J. J. Pool, Perth, N. D.	41.51

644	Witmer & Derby, Bathgate, N. D.	39.87
645	Witmer & Derby, Bathgate, N. D.	40.05
646	Witmer & Derby, Bathgate, N. D.	40.04
646B	N. Balfour, Rocklake, N. D.	39.43
647	T. A. Finley & Co., Westhope, N. D.	40.27
648	V. Lindholm, Lisbon, N. D.	39.71
649	C. Nielson & Co., Buchanan, N. D.	39.71
650	Davis Drug Co., Minnewaukan, N. D.	39.34
651	Robert Swanlow, Milton, N. D.	41.00
652	E. K. Davis, Estavan, Sask.	38.92
653	E. C. Krueger, Bowbells, N. D.	40.50
654	L. M. Erickson, Ashley, N. D.	39.26
655	Albert Anderson, Wild Rice, N. D.	40.38
656	Albert Anderson, Wild Rice, N. D.	40.05
657	Peterson & Dahle, Hastings, N. D.	38.81
658	Keystone Pharmacy, Casselton, N. D.	40.38
659	Keystone Pharmacy, Casselton, N. D.	40.50
660	John Wallstrom, Sherwood, N. D.	40.05
661	J. T. Knudson, Dazey, N. D.	39.97
662	C. L. Peterson & Co., Overly, N. D.	38.00
663	Geo. A. Johnson, Fairdale, N. D.	38.14
664	D. A. Blackburn & Co., Hansboro, N. D.	38.00
665	Harvey Mercantile Co., Harvey, N. D.	41.00
666	T. H. Dickinson, Ayr, N. D.	39.83
667	Noyes Bros. & Cutler, St. Paul, Minn.	40.50
668	D. W. Leonard, Rollette, N. D.	38.81
669	Twin City Separator Co., Minneapolis, Minn.	39.60
670	W. H. Young & Co., Munich, N. D.	41.00
671	Perth-Amboy Chemical Co., New York, N. Y.	38.70
672	Perth-Amboy Chemical Co., New York, N. Y.	39.03
675	Perth-Amboy Chemical Co., New York, N. Y.	40.72
678	W. N. Bickley, McClusky, N. D.	40.50
679	Geo. Clarke, Sarles, N. D.	38.00
680	Chas. J. Foss, Honeyford, N. D.	41.50
681	C. L. Peterson & Co., Overly, N. D.	40.16
684	Paul Bilden, Northwood, N. D.	41.00
685	O. B. Ulsrud, Columbus, Ohio	41.65
686	S. Almklov, Cooperstown, N. D.	39.87
687	Amenia & Sharon Land Co., Amenia, N. D.	39.03
688	O. M. McWherter, Spiritwood, N. D.	40.09
690	E. C. Krueger, Bowbells, N. D.	40.86
691	V. Morgan, Omemee, N. D.	39.98
692	Meredith, Drug Co., Fargo, N. D.	38.08
693	J. O. Stroklund, Donnybrook, N. D.	39.42

STOCK FOODS.

Several samples of stock foods have been examined; among these are the following:

Lab. No. 199 S. Medicated Stock Food, Wahpeton Medicated Stock Food Co., Wahpeton, N. D.

Lab. No. 202 S. Wilbur's Stock Food, Wilbur's Stock Food Co., Milwaukee, Wis. Sample submitted by Samuel Parsons, Grand Rapids, N. D.

Lab. No. 203 S. Poultry Food, J. R. Watkin's Medical Co., Winona, Minn. Sample sent in by Geo. N. Vanier, Devils Lake, N. D.

Lab. No. 205 S. Watkin's Stock Food, J. R. Watkin's Medical Co., Winona, Minn. Sample submitted by Anton Johnson, McCanna, N. D.

Lab. No. 109 S. Special Stock Food, American Standard, American Standard Food Co., Minneapolis, Minn.

Lab. No. 108 S. Kentucky Horse Food, Kentucky Horse Food Co., Davenport, Iowa.

Lab. No. 105 S. Bigler's Condition Powder, G. R. Bigler Co., Springfield, Ill. Sample submitted by S. G. Milling, Milton, N. D.

Lab. No. 98 S. Prussian Stock Food, Prussian Medicine Co., St. Paul, Minn. Sample submitted by Z. W. Rogers, St. Thomas, N. D.

Lab. No. 101 S. International Stock Food, International Stock Food Co., Minneapolis, Minn. Sample submitted by Ed. Johnson, St. John, N. D.

Lab. No. 102 Arabian Stock Food, Arabian Remedy Co., Fergus, N. D.

Lab. No. 103. Guarantee Stock Food, Guarantee Stock Food Co., Grand Forks, N. D.

Lab. No. 104. Guarantee Poultry Food, Guarantee Stock Food Co., Grand Forks, N. D.

Lab. No. 105. McConnon's Stock Tonic, McConnon & Co., Winona, Minn.

Lab. No. 106. McConnon's Poultry Compound, McConnon & Co., Winona, Minn.

Lab. No. 107. Dr. Ward's Stock Tonic, Dr. Ward's Medical Co., Winona, Minn.

Lab. No. 108. Ward's Condition Powder, Dr. Ward's Medical Co., Winona, Minn.

Lab. No. 109. Ward's Medicated Poultry Tonic, Dr. Ward's Medical Co., Winona, Minn.

Some of the claims made for these various stock foods are not based upon real facts. For example, it says with regard to Bigler's Condition Powder: "For hogs this powder is the most effective remedy for all diseases." The range of diseases which they claim to cure in horses are: Botts, colic, debility, diarrhea, distemper, epizootic, founder, gravel, heaves, hide-bound, inflammation of bladder, bowels, kidney or stomach, mange, pneumonia, skin diseases, worms, loss of appetite, roughness of the coat, etc.

One product claims to be highly glutenized when, in reality, it contains nothing that can be classed as a glutenized product. In fact, its composition shows that instead of being glutenized it has a protein content less than that of corn-meal.

The following shows the analyses for these products:

ANALYSES OF STOCK FOODS.

Lab. No.		Water	Ash	Fat	Proteids, Nx 6.25	Crude Fibre	Nitrogen Free Extract
199 S.	Medicated Stock Food	dry	9.73	4.00	26.06	9.68	50.53
202 S.	Wilbur's Stock Food	dry	13.47	11.06	16.06	12.96	46.45
203 S.	Poultry Food	dry	35.78	7.46	6.52	11.69	38.55
205 S.	Watkin's Stock Food	5.53	34.56	8.01	10.39	10.09	31.42
109 S.	Special Stock Food	dry	20.49	50.56	12.25	12.08	49.55
108 S.	Kentucky Horse Food	dry	21.87	4.15	12.86	11.42	49.70
105 S.	Bigler's Condition powder	dry	10.47	11.42	32.87	8.03	37.21
98 S.	Prussian Stock Food	dry	16.01	1.99	8.33	16.38	51.29
101 S.	International Stock Food	dry	12.63	7.70	11.66	12.24	55.87
102	Arabian Stock Food	5.53	13.96	32.17	12.06	7.09	29.19
103	Guarantee Stock Food	7.32	9.09	5.12	23.06	9.15	46.26
104	Guarantee Poultry Food	6.62	10.51	5.36	24.14	9.21	44.16
105	McConnons' Stock Tonic	7.86	18.38	4.85	11.38	13.79	43.74
106	McConnons' P'ltry Com.	4.86	31.44	2.80	21.12	9.07	30.71
107	Ward's Stock Tonic	5.95	29.06	13.60	7.00	14.72	29.67
108	Ward's Condition powder	5.49	21.31	16.47	13.12	18.34	25.27
109	Ward's Poultry Tonic	6.36	24.07	6.92	24.43	7.20	31.02

In commenting on the above I cannot do better than to repeat what I stated in a former report for 1905:

"Like bitters sold for human consumption, these foods are

claimed to be a panacea for all the ills of animals. Such claims do not seem to be based on facts, judging from experiments which have been made with them by careful investigators. Animals in health do not need medicines, and to stimulate continuously the activity of one set of organs by means of drugs will usually result in functional derangement. The cost of nutritives in these foods is excessive. If the animals are sick, like man, they should be treated for a specific complaint and by one competent to judge of their ailment. If they need a tonic, then the purchase of a few simple ingredients like slippery elm, fenugreek, gentian, golden seal, to which are added a small quantity of flaxseed, charcoal, salt and saltpeter, poplar, and willow barks, and we have a tonic, which if mixed with bran or linseed meal, is as good as the majority of those purchased upon the market."

LINSEED MEAL.

During the year three samples of linseed meal have been submitted and analyzed as follows:

Lab. No.		PRODUCED OR SUBMITED BY
89	Ground linseed cake	Minnesota Linseed Oil Co., Minneapolis, Minn.
101	Linseed meal	Minnesota Linseed Oil Co., Minneapolis, Minn.
110	Linseed meal	Submitted by Hugo Frey, Leondard, N. Dakota

These samples contained:

	No. 89	No. 101	No. 110
Water	9.30	dry	6.69
Ash	5.50	5.51	4.80
Fat	4.16	4.50	4.78
Proteids	38.81	37.43	35.68
Crude Fibre	6.66	7.93	8.21
Nitrogen free extract	35.57	44.63	39.84
	100.00	100.00	100.00

BRAN AND MIDDLINGS.

Three samples were recently analyzed, all from the Chaffee-Miller Milling Co., Casselton, N. D.

	Middlings	Fine Middlings	Wheat Bran
Water	9.47	8.12	8.07
Ash	4.98	3.03	6.53
Fat	5.79	4.71	4.88
Proteids N X 6.25	16.43	15.37	13.43
Crude Fibre	8.11	3.41	9.83
Nitrogen free extract	55.16	65.36	57.26
	100.00	100.00	100.00

RUST AFFECTED STRAW.

A number of samples of straw have been analyzed to determine their chemical composition and to ascertain whether straw seriously affected by rust retains to a larger extent its feeding value than cases where such straw is not affected and the grain attains to a greater degree of maturity. The following samples were analyzed:

Lab. No.		
224 S.	Great Northern Select Oats	Badly rusted
225 S.	New Zealand Oats	"
226 S.	Siberian White Oats	"
227 S.	An ordinary sample of oat straw	"
228 S.	Fife Wheat Straw	Very badly rusted
229 S.	Blue-stem wheat straw	"

ANALYSES OF STRAW—WATER FREE

	224	225	226	227	228	229
Ash	10.27	9.03	8.78	11.28	15.20	12.27
Fat	1.82	1.62	2.13	2.46	2.25	1.65
Proteids	1.32	1.75	1.85	2.81	4.73	3.33
Crude Fibre	37.01	40.81	37.17	35.76	33.86	38.32
Nitrogen free extract	49.58	46.79	50.07	47.69	43.96	44.43
	100.00	100.00	100.00	100.00	100.00	100.00

It will be observed that except for the matter of ash, which for a water free substance is higher than the average given by most other stations, that there has been no increase in the protein value of the straw. In fact, the average protein content for a number of examinations, as reported in the U. S. Department of Agriculture Compilation of Analyses of American Feeding Stuffs, is given as 4.4 per cent. for oat straw and 3.8 per cent for wheat straw. The nutritive value, therefore, contained in this straw is not greater than the average straw which has not been affected seriously by rust; and would seem to indicate that not only is there less nutritive value contained in the kernel, but there is also a deficiency of food material in the straw itself.

PARIS GREEN.

Under the North Dakota Law dealers in paris green are obliged to deposit a sample with the Agricultural Experiment Station, and to procure a license for the sale of the same. Any sample

of paris green which contains less than 50 per cent of total arsenious oxide, or more than 4 per cent of free or uncombined arsenious oxide, shall be deemed adulterated.

During the past year six samples have been submitted for examination with results as follows:

Lab. No.		Uncombined Arsenious Oxide	Total Arsenious Oxide
112	A. B. Ansbacher & Co., New York, N. Y.	2.21	54.14
113	F. L. Lavunburg, New York, N. Y.	1.87	57.47
114	Fout & Porterfield, Fargo, N. D.	1.87	54.04
115	Noyes Bros. & Cutler, St. Paul, Minn.	1.75	54.04
116	Bulk sample submitted	2.00	54.13
117	J. N. Mathews, Larimore, N. D.	1.75	56.40

It will be observed that all these samples come well within the requirements of the Paris Green Law, and show a very marked improvement over those of previous years, when the analyses showed as high as 18.77 per cent of uncombined arsenious oxide.

SUGAR BEETS.

Three samples of sugar beets from Williams County were submitted for analyses; the results of the examinations were as follows:

	LABATORY NUMBER 221	222	223
Weight of beets	5lb 7oz.	3lb 11oz.	2lb 8oz.
Weight of juice	2lb 1oz.	1lb 8oz.	1lb 0oz.
Specific gravity of juice	1.085	1.079	1.051
Sucrose	13.8	14.80	8.40

MINERAL PRODUCTS.

There was submitted by N. B. Still, Beach, N. D., a soft, black product, in general appearance not unlike a mixture of asphaltum and pitch. This product oozes from the earth in several parts of the state, and has several times been submitted for examination.

A partial analysis gave the following results:

	Percent
Water	71.84
Volatile and organic matter	13.20
Ash (soluble)	5.13
Ash (insoluble)	6.83
Total	100.00

This product oozes out from a locality of lignite coal veins, but gave no reaction for any asphaltum products; the insoluble

ash being mainly silica and sand, while the soluble portion of the ash consisted of lime, iron compounds, alumina and alkalies.

RECOMMENDATIONS AND ACKNOWLEDGEMENTS.

The analytical work is largely the results of my assistants who have performed carefully and efficiently the work that has been assigned each of them by the department.

I desire, therefore, to commend them for the efforts put forth in furthering the work of the department, and for the cordial support which they have at all times given me.

During the year there have been a number of changes in the department, partly the result of growth, and in part due to the fact that other institutions have been able to offer greater inducements than could be afforded by this department. Frequent change of laboratory force is a source of great weakness in the conducting of lines of research for, as soon as a man becomes efficient in a particular line of work, if he is induced to accept other positions, the department becomes much weakened, and seriously handicapped in pushing forward investigations.

During the past year there was built a small flour mill and machinery installed for conducting investigations in determining the milling and baking qualities of various wheats as grown in different parts of the state, and of the different varieties and strains of wheat. I desire to recommend that this line of work be continued, and so enlarged as to prove of assistance not only to the farmers of the state, but to the millers of the state. To continue this work will mean the necessity of employing during the year a competent miller to carry on the milling work, and it is believed that the expenditures made for this purpose would be well re-paid to the state, and bring to the Station the support of many manufacturers of flour now desirous of having their products tested near home in order that the results may be secured at an earlier date than where tests are made outside of the state.

Respectfully submitted,

E. F. LADD,
Chemist.

DEPARTMENT OF BOTANY

DIRECTOR J. H. WORST:

SIR: I herewith submit an outline of the Experiment Station work of this department for the season of 1907, this being my eighteenth annual report upon the various lines of work of the Botanical Department.

Changes in the Staff of the Department, in Equipment and Facilities for Work: During the past year, the department has labored under some difficulties because of changes in the working staff. Mr. F. J. Pritchard resigned July 1st to accept a fellowship in Cornell University. Some difficulty was experienced in filling the vacancy thus occasioned and the work which was well under way, was much delayed.

The work which was originally assigned to Assistant Professor Pritchard has been subdivided and two new men have been assigned to work in this division of the Experiment Station work. Mr. F. J. Seaver, of Columbia University, becomes assistant in mycology and Mr. T. D. Beckwith, of U. S. Department of Agriculture, assistant in bacteriology and plant pathology. The laboratories for the botanical work and bacteriological work have been modified and somewhat enlarged and suitable new apparatus has been installed for the carrying on of more perfect culture work with fungi and bacteria. A seed testing room has also been arranged for and this work will be pursued in more systematic manner than in the past. The Station work of the department is now so assigned to the four workers in the Department of Biology that each man is able to devote his special attention to that phase of the Station work for which his training and interests best fit him.

Prof. W. B. Bell, assistant professor of biology and physiology, is directly concerned with a survey of the native seed-bearing plants of the state and one-fourth of his time is assigned to this work in the Experiment Station. An outline report for his work during the summers of 1906 and 1907 will be appended to this report. Mr. F. J. Seaver devotes his Station time to the study of the fungi of the state, making a complete survey of saprophytic and parasitic fungi with the special view of learning the relationship which each holds to economic plants and crops of the state. He will more especially work up the systematic side

of this proposition. One-fourth of his working time in the institution is assigned to this Station work. An outline of his work for the past season upon the parasitic fungi is also included in this report. Mr. Seaver commenced work at the institution August 1st.

Mr. T. D. Beckwith commenced work in the institution September 1st and three-fourths of his time is assigned to Experiment Station work. This work is to be directed principally along the lines of studying the indefinite fungus and bacterial flora of the soil with a view to connecting the results observed with the chemical investigations and breeding investigations conducted in the institution with the hope that light may be thrown upon the causes of crop depletion; that new principles of farming may develop to bring about a proper adjustment of agricultural conditions in the soil.

Aside from the executive work of the Experiment Station, including an oversight of the various investigations conducted by the assistant staff, I have assigned to myself as head of the department, the duties of carrying the general work that would naturally fall to the Experiment Station botanist and to certain intensive studies upon plant breeding and plant disease.

The department draws funds from both the Adams and Hatch Acts, and according to the amount so used, the following is the present assignment for the work:

Bolley, one-fourth time to the Hatch fund and one-half time to the Adams fund; Bell, one-fourth time to the Hatch fund; Seaver, one-fourth time to the Adams fund; Beckwith three-fourths time to the Adams fund.

The remaining fractional time represents the time assigned to college teaching for each man and the proportional funds that each man draws from college sources.

The time thus assigned to Experiment Station work represents that of two men working continuously. Though some difficulties are experienced in experimental work because of the union of teaching and Station work, the nature of the work in this department is of such a broad character that the work of four men each working upon the specialty for which he is particularly fitted, I believe, more than compensates both the Station and the college for any possible deficiency the system may cause otherwise. As now adjusted, the department is in splendid condition for doing effective investigation work. Each man's work is of such nature that the time when he is most needed for the Station investigations he is relieved from the teaching work. In the work of this department the two lines are complementary and advantageous, if the division of time is properly maintained and adjusted. The de-

partment maintains the system of conducting practically all of its labor by the use of students. While some difficulties are experienced because of interruptions which come because of studies it is yet believed that more efficient aid is procured because of the interest which the students have in the work and there can be no question but that students who have an opportunity for this work receive much benefit, and becoming acquainted with the experimental work, act as a means of conveying the facts directly to the people of the state.

Lines of Investigation: A general survey of the plants of the state is being conducted by Messrs. Bell and Seaver. The survey includes not only the collection of all types of plants observable but a systematic observation of the topography, soils and substrata upon which the plants are found. A survey as effecting the seed plants is conducted, in connection with the geological survey and the same areas that are mapped and described geologically by the department of geology are studied with reference to the plants and the habitat of each. It is hoped that records will be made in this work which will prove of much information in the future as affecting the understanding of the changes which may be brought about by the breaking up and cultivation of the areas concerned. By the native plants which are known to be present, and by the knowledge of fungus diseases which are native, we are able to draw a fair conception of what may be expected under cultivation in a region and are thus enabled to answer many questions effecting the agriculture of the state which could not be well understood otherwise.

The studies under Prof. Bell contemplate an understanding of forage conditions, weed problems, and soil relations of plants. The survey, as conducted by Prof. Seaver, consists of simply the studies upon fungi and especially those concerned in the production of diseases of field crops. A collection and study of all available fungus specimens is made. When one is found which is directly associated with a particular economic plant or crop, or with soil in such relations as to cause suspicion that it in any way influences the life of a cropping plant, special attention is to be given to such forms. We are especially concerned with systematic studies with a view to co-ordinating our knowledge of the plants of the state. Any persons interested in any particular plant of the state, whether as to seeds or other economic features, will find it to their interest to forward specimens of same to this department, appending such information and questions as will convey the information which they wish. Careful attention will be given to the matter and such a return report made as is believed most nearly applies to the conditions. If the farmers, and especially the

teachers, of the state will take an interest in this phase of their work, it is believed that this department is in position to greatly aid them in their work of understanding the plants and plant conditions of the state. In asking this aid, they are not only, perhaps, doing themselves a favor but are conferring a favor upon this department by furnishing much information which otherwise might not be easily obtained; and this again, can be systematized and made of educational use to others. The department is in position to furnish by exchange or purchase collections of flowering plants, seeds or fungi to schools of the state or to teachers at the minimum cost for containers, etc. Address all communications or consignments of specimens to the Department of Botany, North Dakota Agricultural College.

Notes on North Dakota Fungi by Fred J. Seaver: Specimens of the following parasitic fungi have been collected during the past season. A number of the species here reported are recorded for the state for the first time; others are already in the North Dakota Agricultural College herbarium.

PHYCOMYCETES.

Peronosporales.

ALBUGO BLITI (Biv.) Kuntze. On leaves of *Amaranthus retroflexus*. Agricultural College grounds. Common throughout the state.

ALBUGO CANDIDA (DC) Kuntze. On leaves, stems and fruit of *Capsella bursa-pastoris*. Fargo, Aug., 1907; also on leaves of *Brassica arvensis*, Sykeston, July, 1907. Common.

ALBUGO PORTULACAE (DC) Kuntze. On leaves of *Portulaca oleracea*. Agricultural College grounds, Aug., 1907. Very common. At times sufficiently abundant to hold this weed in control.

BASIDIOPHORA KELLERMANII (Ellis & Halsted) Wilson. On leaves of *Iva xanthiifolia*. Sykeston and Fargo, summer and autumn, 1907. This species has been recorded for the state by Guy West Wilson (Bull Torrey Club, 34:395) from material sent to him by the writer, which is the same material reported on at this time. The above citation is its first record for the state.

PLASMOPARA VITICOLA (B & C) Berl. On leaves of wild grapes, *Vitis riparia*. Fargo woods, 1907. This very destructive fungus is a native of the United States and probably occurs in this country on both wild and cultivated grape wherever the host occurs and is responsible for great damage to the grape crop by bringing about

early falling of the leaves and consequently a reduction of the crop not only in the season in which the fungus occurs but the following season as well.

ASCOMYCETES.

Perisporiales.

Erysiphe cichoracearum DC. On leaves of *Heliopsis scabra*. Fargo woods, Aug. 1907. This species is common on a number of hosts.

Erysiphe polygoni DC. On leaves of *Polygonum aviculare*. Fargo, Aug., 1907. Very common in late summer and autumn.

Microsphaera diffusa Cooke & Peck. On leaves of *Symphoricarpos occidentalis*. Fargo woods, Aug., 1907. Common.

Microsphaera alni (Wallr.) Winter. On leaves of *Viburnum prunifolium* and *Corylus americana*. Fargo, woods, Aug., 1907.

Microsphaera clintonii Peck. On leaves of *Tilia americana*. Fargo, woods, Aug., 1907. This species has been reported from New York to Mississippi and west to Minnesota but so far as noted has not before been recorded for North Dakota.

Phyllactinia suffulta (Reb.) Sacc. On leaves of *Cornus stolonifera*. Fargo, woods, autumn, 1907. No record seen for the state.

Sphaerotheca mors-uvae (Schw.) B & C. On leaves of cultivated gooseberry. Specimens of this species have often been sent in for identification. It is common to the state on wild and cultivated plants.

Hypocreales.

Cordyceps pistiliformis B & Br. On scale insects on living branches of *Xanthoxylum americanum*. Fargo, woods, Aug., 1907. The plants of this species collected in North Dakota do not show the mature asci but otherwise correspond well with specimens of the above named species which have been previously examined.

Claviceps purpurea (Fries) Tul. Collected on various hosts, *Bromus ciliatus* and *Agropyron violaceum*. Fargo, Aug., 1907. This fungus attacks both cultivated and wild grasses causing a great reduction in the crop. When eaten by animals it brings about a characteristic disease and also when present in grain in even small quantities does much harm. This fungus which is known as ergot is an official drug.

HYPOMYCES AURANTIUS (Pers.) Fuckel. On Polyporus, Hawk's Nest, July, 1907. The plants of this genus occur on other fungi and often cause much damage among cultivated mushrooms.

HYPOMYCES LACTIFLUORUM (Schw.) Tul. On *Lactarius* sp. Fargo woods, autumn, 1907. All of the host plants of this species collected during the present season were entirely parasitized by the above named fungus.

HYPOMYES POLYPORINUS Peck. On *Polyporus versicolor*, Fargo, autumn, 1907. The only record seen of this species is for New York and New Jersey. Its occurrence in North Dakota probably indicates a wide range of distribution. Occurring as it does on the under side of the host it is not conspicious and would not be seen unless a special search were made for it. It occurs in abundance in woods near Fargo. While not of great importance itself it occurs on a host which at times is a timber destroyer.

NECTRIA PURPUREA (L.) Wilson & Seaver. On various trees and shrubs, Fargo, Aug., 1907. While the mature fruit of this species occurs on dead limbs it is a very destructive wound parasite often causing much damage to cultivated trees and shrubs.

NECTRIA EPISPHAERIA (Tode) Fries. On sphaeriaceous fungi, Fargo, autumn, 1907. While this fungus would appear to be of slight importance it may become of importance since it occurs as a parasite on other forms which are destructive.

NECTRIA COCCINEA (Pers.) Fries. This and the very closely related form *Nectria ditissima* Tul. while usually occurring in fruit on dead branches are no doubt destructive parasites. *Nectria ditissima* is the cause of the apple tree canker and also attacks numerous other cultivated trees. It is doubtful if these two supposed species are distinct from each other.

PLEONECTRIA BEROLINENSIS Sacc. On branches of *Ribes rubra*, Agricultural College gardens, Fargo, autumn, 1907. This species resembles in external appearance *Nectria purpurea* (L) Wilson and Seaver but differs in the structure and size of the spores which are much larger and many times divided. This species is commonly reported on the cultivated currant and a search showed it to be present in the College gardens. The plants come to fruit on the dead branches but occur close down to the living parts and the vegetative phase of the plant no doubt kills the branches. It is commonly reported as a destructive parasite to the currant. No previous record has been made of it, for this state.

Dothideales.

PHYLLACHORA GRAMINIS (Pers.) Fuckel. On leaves of wild rye. *Elymus canadensis.* In open woods, Fargo, autumn, 1907. The species occurs on leaves of various species of grasses causing yellowish spots, the fungus finally coming to fruit and giving rise to black spots resembling the teleutosporic phase of a rust except that the black patches are smooth and shining.

PLOWRIGHTIA MORBOSA (Schw.) Sacc. On living branches of *Prunus virginiana.* Fargo, woods, autumn, 1907. Abundant and common. This is the most destructive fungus disease known to the wild and cultivated plum and cherry. It is very conspicous forming large black knots on the branches of the trees. The only known remedy is to remove and burn the infected portions.

Pezizales.

PSEUDOPEZIZA MEDICAGINIS (Lib.) Sacc. On leaves of *Medicago sativa.* Agricultural College gardens. Fargo, Aug., 1907. This disease gives rise to yellowish spots on the leaves of the host and often causes a great reduction in the crop of alfalfa hay.

CENANGIUM FURFURACEUM (Roth.) DeNot. On branches of *Corylus americana.* Fargo, woods, Aug., 1907. The plants come to fruit on the dead but standing branches of the host and often occur in large numbers springing from the inner bark. While the fruit appears on the dead branches there is little doubt but that they are the cause of the death of the host.

FUNGI IMPERFECTI.

MACROSPORIUM TOMATO. Cooke. On fruit of tomatoes. Agricultural College gardens. Common and abundant. Reported to be very destructive to tomatoes in cultivation.

LOWER BASIDIOMYCETES.

Ustilaginales.

TILLETIA TRITICI (Bjerk) Winter. On wheat in cultivation. Agricultural College gardens. Aug., 1907. The cause of stinking smut or bunt of wheat, which may be economically prevented by proper seed treatment.

USTILAGO MAYDIS (DC) Cords. On corn in cultivation. Agricultural College gardens. Sept., 1907. Reported as becoming year by year more abundant in this region. The smut masses should be gathered from the corn crops before mature and then burned.

USTILAGO NEGLECTA, Niessel. On pigeon grass, *Setaria glauca.* or S. *viridis.* Fargo, Aug., 1907. Very common and abundant. This fungus is of much importance in destroying the seed of this noxious weed.

USTILAGO AVENAE, Jensen. On oats in cultivation. Fargo, Aug., 1907. Common. Often causing much damage. May be prevented by use of the formaldehyde method of seed disinfection. See N. D. Exp. Sta. Bul. 27 and 37.

USTILAGO SEGETUM (Bull.) Dittm. On wild barley *Hordeum jubatum.* Fargo, summer, 1907. Very common. Very destructive upon wild barley. The same species probably also transfers to cultivated barley.

Uredinales.

A large number of rusts have been collected in the state.

The following are a few which have been collected during the past season.

AECIDIUM JAMESIANUM, Beck. On leaves of *Asclepias cornuti.* Fargo, Aug., 1907.

AECIDIUM ALLNII, Clinton. On leaves of *Asclepias cornuti.* Fargo, Aug., 1907.

AECIDIUM ALLNII, Clinton. On leaves of *Elaeagnus argentius.* Bathgate, N. D., July, 27 1907.

PUCCINIA TARAXICI, Plow. On leaves of *Taraxacum officinale,* Fargo, Aug., 1907. Common.

PUCCINIA FRAXINATA (Lk.) Arthur. On leaves of *Fraxinus* sp. Fargo, Aug., 1907. Very common on ash leaves.

HIGHER BASIDIOMYCETES.

Agaricales.

POLYPORUS FRAXINOPHILUS, Peck. On living and dead ash trees on Red River, near Fargo, Aug., 1907. This fungus is commonly reported east but so far as known has never before been reported upon for this state. During the past summer and autumn the species has been observed in great abundance on both living and dead ash trees in woods near Fargo. The spores appear to enter the host wherever a small branch has been broken off and grow for a time in the tissues of the host, the fruit later appearing on the trunk of the tree. The fruit first appears as a small white knob but later assumes the form of the ordinary bracket fungus.

The under surface of the mature fruit is of a yellowish color and the upper surface is dark becoming entirely black and cracked so as to resemble charred wood. In some cases as many as six of these fruits have been seen on a single living tree and the species occurs in such abundance as to threaten the destruction of this forest tree.

The Plants of the Williston Area—By W. B. Bell: The territory covered in the plant survey during the year 1906, known as the Williston Area includes sixteen and one-half townships in Williams county located mainly north of Williston, i. e. townships 154 north range 100-101 west, townships 155 and 156 north, range 98-102 west inclusive and township 157 north, range 97-101 inclusive. This area includes a strip of the Missouri river lowlands, the valleys of Sand, Little Muddy and Stony creeks and their branches, together with the adjacent uplands. The land which is being irrigated in the Williston Irrigation Project of the United States Reclamation Service is comprised within these boundaries.

During the summer of 1907, a careful detailed survey was made in southwestern Morton and eastern Hettinger counties. The area extends principally along the north and south forks of the Cannon Ball river, comprising townships 131 and 132 north from range 85 west to 91 west inclusive, an area of fourteen townships. A more rapid and less exhaustive survey was also made in southwestern McKenzie county, covering townships 145 to 148 north and from range 103 to 105 west, inclusive, an area of twelve townships.

A list of the plants of the Williston Area is here appended, orders and genera in alphabetical order.

ACERACEAE.

Maple Family.

Acer negundo L. Box Elder, Ash-leaved Maple. Common along lowlands of Missouri river. A valuable tree for cultivation upon this area as it is hardy, a rapid grower and yields a good wood for fuel and affords shade and shelter beside adding beauty to the landscape.

ALISMACEAE.

Water-Plantain Family.

Alisma plantago aquatica L. Water Plantain.

Sagittaria latifolia, Wild. Broad-leaved Arrow-head.

ANACARDIACEAE.

Sumac Family.

RHUS RADICANS L. Poison, Climbing or Three-leaved Ivy. Poison Oak. A very poisonous plant which should be carefully avoided by susceptible persons.

APOCYNACEAE.

Dogbane Family.

APOCYNUM CANNABINUM L. Indian Hemp. Amy-root. In moist fertile soil along the banks of streams. Also found on sand dune area by Missouri river. The tough fibrous bark was used by the Indians for making twine, nets, etc. The root is an official drug worth eight to ten cents per pound.

ASCLEPIADACEAE.

Milkweed Family.

ASCLEPIAS SPECIOSA Torr. Showy Milkweed.

BORAGINACEAE.

Borage Family.

KRYNITZKIA VIRGATA Gray. Scattering on dry stony hillsides,

LAPPULA TEXANA (Scheele) Britton. Hairy Stickweed. Common over lowlands and prairies. Troublesome to wool growers.

LAPPULA LAPPULA (L.) Karst. European Stickseed. Burseed. Troublesome to wool growers. Occasional in grain fields. Introduced.

MERTENSIA PANICULATA (Ait) Don. Tall Lungwort. In cut in northeast corner of Williston.

CAMPANULACEAE.

Bellflower Family.

CAMPANULA ROTUNDIFOLIA L. Harebell. Blue Bells of Scotland. Abundant throughout the area on hillsides and along shallow grassy cuts. A dainty perennial plant well adapted for flower beds in sheltered places.

LOBELIA SPICATA Lam. Pale Spiked Lobelia. Occasional on dry stony hillsides.

CAPPARIDACEAE.

Caper Family.

Cleome serrulata Pursh. Pink Cleome. In dry soil along coulees and on prairie.

CAPRIFOLIACEAE.

Honeysuckle Family.

Symphoricarpos occidentalis Hook. Wolf-berry. Growing in dense clumps on Missouri lowlands and along banks of creeks and coulees upon fertile loam soils. May be used for ornamental clumps.

CARYOPHYLLACEAE.

Pink Family.

Agrostemma githago L. Corn Cockle. A troublesome weed introduced into cultivated fields and becoming abundant in many fields of the area.

Alsine longipes Coville. Long-stalked Stitchwort. Scattered sparsely over dry stony hillsides and shallow cuts.

Alsine uliginosa Britton. Marsh Chickweed. On wet ground bordering small streams fed by cold springs.

Cerastium arvense L. Field Chickweed. Occasional on dry stony hillsides.

Vaccaria vaccaria Britton. Cow-herb, Pink Cockle, Smooth Cockle. An injurious annual weed introduced into grain fields. Not yet very abundant in this area and should be carefully guarded against as it lowers the grade of grain when its seeds are present. The latter are also poisonous to sheep and cattle.

CHENOPODIACEAE.

Goosefoot Family.

Atriplex canescens (Pursh) James. Bushy Atriplex. In alkaline soil of sloughs. A valuable forage plant.

Chenopodium album L. Lamb's Quarters. White Goosefoot. Pigweed. Scattered over Missouri lowlands and prairies. An injurious weed in cultivated fields and gardens. Used in spring for making "greens."

DONDIA DEPRESSA (Pursh) Britton. Western Blite. Growing in strongly alkaline soil around alkali lakes and pools.

SALICORNIA HERBACEA L. Slender Glasswort. Abundant around edges of alkaline lakes and pools growing on thick crust of alkali.

SALSOLA TRAGUS L. Russian Thistle. Abundant along trails and in waste places. Often a troublesome weed in dry soils.

COMPOSITAE.

Thistle Family.

ACHILLEA LANULOSA Nutt. Western Yarrow. Abundant over prairies, hillsides, cuts and moist banks.

AGOSERIS GLAUCA Greene. Large-flowered. On dry stony hillsides and prairies.

AMBROSIA TRIFIDA L. Horseweed. Bitter-weed. Great Ragweed. King-head. A bad weed about barnyards and waste places and extending into cultivated fields. The presence of its seeds lowers the grade of grain. Eaten freely by horses.

AMBROSIA TRIFIDA INTEGRIFOLIA L. Common with preceding type.

ANTENNARIA APRICA Greene. Rocky Mountain Cudweed. Common on dry stony hillsides.

ARTEMISIA CANADENSIS Michx. Canada Wormwood. On rocky hillsides.

ARTEMISIA CANA Prush. Hoary Sage-bush. On dry, stony hillsides.

ARTEMISIA DRACUNCULOIDES Pursh. Linear-leaved Wormwood. On alluvial flats by Missouri river and over prairie.

ARTEMISIA GNAPHALODES Nutt. Prairie, Western or Cud-weed Mugwort. On alluvial flats by Missouri river.

ARTEMISIA FRIGIDA Willd. Pasture Sage-brush. Wormwood Sage. Very abundant on dry stony or gravely areas and ranging over hillsides and prairies everywhere. Fed upon by cattle especially during winter.

ARTEMISIA LONGIFOLIA Nutt. Long-leaved Mugwort. In scattered clumps in flood plain of Missouri river.

Artemisia ludoviciana Nutt. Lobed Cud-weed. Common on dry stony hillsides. Much used by stock in winter.

Aster adscendens Lindl. Western Aster. On moist sandy banks of Cow Creek, in shallow cuts and on dry stony hillsides.

Aster campestris Nutt. On dry stony points along Cow Creek.

Aster foliaceus Lindl. Leafy-bracted Aster. On alluvial flats by Missouri river.

Aster laevis L. Smooth Aster. On dry stony hillsides.

Aster multiflorus Ait. Dense-flowered Aster. White Wreath Aster. In dry situations on hillsides and low flat valleys.

Aster ptarmicoides (Nees) T. & G. Upland White Aster. Along banks and coulees.

Brauneria angustifolia (DC) Heller. Narrow-leaved Purple Coneflower. Abundant on open prairie and dry stony hillsides. A good plant for ornamental beds. The roots of this plant are used in the manufacture of the drug Echinacea and at present are worth twenty to thirty cents a pound. The roots should be collected in autumn. Since this plant grows abundantly upon dry, stony and otherwise untillable land it offers a profitable use of such places which are quite numerous and extensive in this area. The best quality is said to be produced upon dry soil, hence the conditions here are very favorable for its production. It grows well under cultivation and should receive the careful attention of the settlers of this region as a means of increasing their profits.

Carduus altissimus L. Tall or Roadside Thistle. Common on hillsides and prairie.

Chrysopsis villosa (Pursh) Nutt. Hairy Golden Aster. Abundant on uplands and lowlands throughout the area.

Erigeron asper Nutt. Rough Erigeron. Common on dry stony hillsides.

Erigeron pulchellus Michx. Robin's or Poor Robin's Plantain. Occasional on hillsides.

Erigeron pumilus Nutt. Low Erigeron. Common on open rolling prairie, hillsides and dry banks.

Gaillardia aristata Pursh. Great-flowered Gaillardia. Abundant on dry stony hillsides, hilltops and open prairie.

GRINDELIA SQUARROSA (Pursh) Dunal. Broad-leaved Gumplant. Common on dry lowlands along streams.

HELENIUM AUTUMNALE L. False or Swamp Sunflower. Sneezeweed. Growing at edge of pool at bottom of a very deep rugged coulee.

HELIANTHUS ANNUUS L. Common Sunflower. Common over the area becoming much larger on cultivated fields. This plant yields honey, dye, fodder, oil, food and textile fibre.

HELIANTHUS GIGANTEUS L. Tall or Giant Sunflower. On alluvial flats by Missouri river. A valuable ornamental perennial plant producing abundant foliage and fleshy edible root.

HELIANTHUS SCABERRIMUS Ell. Stiff Sunflower. Common over hillsides on dry stony rolling prairie.

HYMENOPAPPUS FILIFOLIUS Hook. Low Tufted Hymenopappus. Common over dry stony prairie hillsides.

IVA AXILLARIS Pursh. Small-flowered Marsh Elder. On lowlands along Missouri river in alkaline soil.

IVA XANTHIIFOLIA (Fresen) Nutt. Burweed Marsh Elder. A large annual weed growing in waste places and spreading into grain fields.

LACINARIA PUNCTATA (Hook) Kuntze. Dotted Button-Snakeroot. Common on dry stony hillsides and open rolling prairie.

LACINARIA SCARIOSA (L) Hill. Large Button-Snakeroot. Common on low flat dry soil along Little Muddy creek.

LACTUCA HIRSUTA, Muhl. Hairy or Red Wood-Lettuce. On sand dune area along Missouri river.

LACTUCA PULCHELLA (Pursh) DC. Large-flowered Blue Lettuce. In moist soil on Missouri river lowlands and along coulees and streams.

LEPTILON CANADENSE (L) Britton. Horseweed. Canada Fleabane. On alluvial flats by Missouri river.

LYGODESMIA JUNCEA (Pursh) D. Don. Rush-like Lygodesmia. Known locally as Break-weed because of its tendency to spread over newly broken land and make a dense and troublesome growth. It is difficult to eradicate because of its perennial root system. A native plant scattered over the sandy upland prairie soil.

MACHAERANTHERA SESSILIFLORA (Nutt) Greene. Viscid Aster.

Abundant on dry sloughs and open hillsides bordering Little Muddy creek.

Pyrrocoma lanceolata Greene. On low dry slough land.

Ratibida columnaris (Sims) D. Don. Long-headed or Prairie Coneflower. Common on lowlands, hillsides and prairie throughout the area.

Sideranthus spinulosus (Nutt) Sweet. Cut-leaved Sideranthus. South of Williston in McKenzie county. On dry hillsides.

Solidago canadensis. L. Canada Golden-rod. On alluvial flats of Missouri river.

Solidago missouriensis Nutt. Missouri Golden-rod. Common over valleys, hillsides and prairie.

Solidago rigida L. Stiff or Hard-leaved Golden-rod. On low dry sloughs.

Taraxacum taraxacum (L) Karst. Dandelion. Just making a start in Williston. The root is used as an official drug. Used largely for "greens" in the spring. It is a serious pest in lawns and everything possible should be done to prevent its spread.

Xanthium canadense Mill. American Cocklebur. Sea Burdock. Very abundant over Missouri river lowlands and adjoining terraces. An exceedingly troublesome weed in cultivated fields and waste places. May be controlled by careful cultivation or by chemical sprays.

CONVOLVULACEAE.

Morning glory Family.

Convolvulus sepium L. Hedge or Great Bindweed. Rutland Beauty. Common in moist situations on alluvial flats by Missouri river and along banks of streams and coulees. A very great weed pest when in cultivated areas.

CORNACEAE.

Dogwood Family.

Cornus stolonifera Michx. Red-osier Cornel or Dogwood. Common on lowlands of Missouri river.

CRUCIFERAE.

Mustard Family.

ARABIS HIRSUTA (L) Scop. Hairy Rock-cress. Along a shallow cut in the northeast corner of Williston.

BRASSICA ARVENSIS B. S. P. Wild Mustard. A bad weed just being introduced into grain fields and gardens here. Should be rigidly controlled.

BURSA BURSA-PASTORIS (L) Britton. Shepherd's Purse. A troublesome weed in lawns and meadows. Introduced here and rare at present.

CAMELINA SATIVA (L) Crantz. False Flax. A bad annual weed especially troublesome in flax fields. Found by a small garden in the northeast corner of Williston and by coal bank in Sec. 24, Twp. 136 R. 101. Rare at present.

CONRINGIA ORIENTALIS Dumont. Hare's ear Mustard. A bad introduced weed in the Northwest which is just getting started here.

ERYSIMUM ASPERUM DC. Western Wall-flower. Common on dry, stony hillsides.

ERYSIMUM CHEIRANTHOIDES L. Wormseed or Treacle Mustard. Occasional on cultivated land. A rather troublesome weed.

ERYSIMUM INCONSPICUUM MacM. Small Wall-Flower. Abundant along the lowlands along Little Muddy creek and ranging up over the adjacent hills and prairie.

LEPIDIUM APETALUM Willd. Apetalous Pepper-grass. Common weed over hillsides and prairie.

LESQUERELLA SPATHULATA Rydberg. Low Bladder-pod. Found growing in crevices of the rock on buttes south of Williston in McKenzie county.

RORIPA SINUATA Nutt. Spreading Yellow-cress. Occasional along banks of streams.

SELENIA AUREA Nutt. Selenia. A rare plant along the Little Muddy lowlands.

SISYMBRIUM ALTISSIMUM L. Tumbling Mustard, Tall Sisymbrium. An exceedingly bad weed just starting here.

CYPERACEAE.

Sedge Family.

Carex adusta Boott. Browned Sedge. Along bottom of dry coulees.

Carex liddoni Boott. Around edges of small pools of water.

Carex filiformis L. Slender Sedge. On wet ground along small streams.

Carex stenophylla Wahl. Involute-leaved Sedge. On open rolling prairie, at base of hills in deep coulees and along Little Muddy bottom lands.

Carex trichocarpa Muhl. Hairy-fruited Sedge. Abundant along Little Muddy creek and around pools among the hills.

Scirpus fluviatilis A Gray. River Bulrush. In shallow water along streams and sloughs.

Scirpus lacustris L. Great Bulrush. Along edges of streams and sloughs.

Scirpus subterminalis Torr. Water Club-rush. On wet ground bordering small streams in deep coulees.

ELAEAGNACEAE.

Oleaster Family.

Elaeagnus argentea Pursh. Silver-berry. Common on stony hillsides and banks of streams. This makes an excellent ornamental shrub for hedges and clumps.

Lepargyraea argentea (Nutt) Greene. Buffalo-berry Bullberry. Common throughout the area on hillsides and banks. Bears an excellent jelly producing fruit, and is one of our best native ornamental shrubs for hedge construction, etc.

Lepargyraea canadensis (L) Greene. Canadian Buffalo-berry. Common along Missouri lowlands and coulees. Valuable as an ornamental shrub.

GENTIANACEAE.

Gentian Family.

Gentiana affinis Griseb. Oblong-leaved Gentian. Common

in low, moist situations along streams, coulees and in depressions on hillsides.

GERANIACEAE.

Geranium Family.

GERANIUM DISSECTUM L. Cut-leaved Crane's-bill. Occasional on low wet ground by streams.

GRAMINEAE.

Grass Family.

AGROPYRON CANINUM (L) R&S. Awned Wheat-grass. Makes a good growth on low moist soil and extends up the hillsides of rolling prairie. Under cultivation produces a good quality of hay.

AGROPYRON TENERUM Vasey. Slender Wheat-grass. The predominant grass of the Missouri lowlands and one of the principal grasses throughout the area. It grows well under cultivation and is one of the best native grasses for hay in the state.

AGROPYRON VIOLACEUM (Hornem) Vasey. Purplish Wheat-grass. One of the principal grasses of the area. It yields an excellent quality of hay and thrives under cultivation. Under irrigation it makes a splendid growth on the alkaline lowlands bordering Little Muddy creek tending to displace other grasses. It will probably prove to be one of the best grasses to grow upon the recently irrigated lands in this region.

ANDROPOGON FURCATUS Muhl. Forked Beard-grass. Common along bottom of coulees and extending a short distance up the hillsides. A valuable hay and pasture grass.

ANDROPOGON SCOPARIUS Michx. Broom Beard-grass. Common grass growing in tufts on dry stony hillsides. Also valuable as a hay and pasture grass.

BECKMANNIA ERUCAEFORMIS (L) Host. Beckmannia. On wet soil by edges of streams and sloughs throughout the area.

BOUTELOUA CURTIPENDULA (Michx) Torr. Racemed Bouteloua. On dry stony hillsides. A good grazing grass.

BOUTELOUA OLIGOSTACHYA (Nutt) Torr. Grama-grass. Bunch-grass. Buffalo-grass. Abundant over valley, hillside and prairie throughout the area. One of the most nutritious and valuable pasture grasses of the western prairie.

Bromus ciliatus L. Fringed Brome-grass, Wood Chess. Occasional on hillsides.

Bromus inermis Leyss. Hungarian Brome-grass. The cultivated Brome-grass which was running wild in a few places. A very valuable hay and pasture grass which has been widely introduced into this state and the specimens indicate a thrifty growth here.

Calamagrostis neglecta (Ehrh) Gaertn. Narrow Reed-grass. Forms a large percent of the grass of the Little Muddy Valley and of the adjoining prairies.

Calamagrostis montanensis. Beal. Occasional on open rolling prairie.

Calamovilfa longifolia (Hook) Hack. Long-leaved Reed-grass. Common over valley, hillsides and prairie throughout the area. Its stout horizontal rootstocks bind loose sandy soil together.

Catabrosia aquatica (L) Beauv. Water Whorl-grass. Grows in wet soil or in water of streams often forming a dense boggy mass.

Distichlis spicata (L) Greene. Marsh Spike-grass, Salt-grass. A salt loving grass. Abundant in alkaline soils both wet and dry. Occasional on prairie.

Elymus canadensis L. Nodding Wild Rye. Common on alluvial flats of the Missouri river and along banks of Little Muddy creek and its tributaries. A good crop of hay is sometimes obtained from this grass. A fair seed producer.

Eriocoma cuspidata Nutt. Silky Oryzopsis. Growing in clumps in edge of sand dune area by Missouri river.

Festuca ovina L. Sheep's Fescue-grass. Growing abundantly on alkaline, clay and gravel soils on the lowlands of the Little Muddy creek. Forming one of the principal grasses in these valleys.

Hordeum jubatum. L. Squirrel-tail grass. Foxtail, Wild Barley. In waste places along Great Northern Railroad tracks and scattered along the streams and coulees. A troublesome weed. Hard to eradicate. Of no agricultural value and injurious to cattle when fed as hay, the long sharp awns causing ulcerations. It also harbors the wheat rust fungus.

Koeleria cristata (L) Pers. Koeleria. Abundant on stony

or sandy hillsides and prairie. Forms one of the principal grasses of the sandy prairie.

MUHLENBERGIA RACEMOSA (Michx) B.S.P. Marsh Muhlenbergia, Wild Timothy. Common on alluvial flats of the Missouri.

PANICUM VIRGATUM L. Tall Smooth Panicum. Common on moist or dry soil in sloughs, coulees and along streams extending well up on hillsides. Not relished by cattle.

PANICULARIA AMERICANA (Torr) MacM. Reed Meadow-grass. Tall Manna-grass. In wet soil in edge of streams and pools.

PHRAGMITES PHRAGMITES (L) Karst. Reed. Abundant along banks of Cow creek and other streams. Important as it produces much wild bird food.

PHLEUM PRATENSE L. Timothy. An excellent introduced grass for hay and forage. One fine field on the prairie indicates that this valuable grass may be cultivated with profit here if properly done.

POA ARIDA Vasey. Prairie Spear-grass. Scattered between hills of rolling prairie.

PUCCINELLIA AIROIDES (Nutt) Wats & Coult. Slender Meadow-grass. Abundant in alkaline soil of the flood plain of Little Muddy creek and scattering in patches elsewhere.

SPARTINA CYNOSUROIDES (L) Willd. Tall Marsh-grass. Common in wet situations along streams and sloughs.

SPOROBOLUS CUSPIDATUS (Torr) Wood. Prairie Rush-grass. On dry open prairie and dry stony banks of Cow creek.

SPOROBOLUS HETEROLEPSIS A. Gray. Northern Dropseed. In wet and dry situations in sloughs and streams and ranging up over hillsides. Used for hay but is tough to cut and not of very good quality. Thrives on strongly alkaline soil.

STIPA COMATA Trin & Rupr. Western Stipa. One of the principal grasses of the prairie and uplands throughout the area. A valuable pasture grass and used largely for hay but frequently causes injury to stock, especially lambs, as the long barbed points of the seed penetrate the delicate lining of mouth and throat causing inflammation and ulceration.

STIPA VIRIDULA Trin. Green Stipa. Abundant on the alluvial soil along Missouri lowlands and ranging over prairie though much less plentiful than the preceding species. Its feeding qualities are similar.

GROSSULARIACEAE.

Gooseberry Family.

Ribes setosum Lindl. Bristly Gooseberry. On stony hillsides near streams. The presence of excellent native gooseberries gives promise of good fruit of this sort either by the cultivation and improvement of native varieties or the introduction of hardy cultivated forms.

HALORAGIDACEAE.

Water-milfoil Family.

Hippuris vulgaris L. Bottle Brush. Mare's-tail. Joint-weed. An aquatic plant occasionally found in pools and streams. Considered poisonous to stock.

HYDROPHYLLACEAE.

Water-leaf Family.

Macrocalyx nyctelea (L) Kuntze. Nyctelea. Occasional in moist situations along coulees. Weed in grain fields.

IRIDACEAE.

Iris Family.

Sisyrinchium campestre Bicknell. Prairie Blue-eyed Grass. Along streams and prairie hillsides.

JUNCACEAE.

Rush Family.

Juncus bufonius L. Toad Rush. On wet ground by side of small streams.

Juncus longistylis Torr. Long-styled Rush. Abundant along streams, sloughs and low ground.

Juncus tenuis Willd. Slender Rush. Yard Rush. Along the margin of small streams and pools both in and out of the water.

LABIATAE.

Mint Family.

Agastache anethiodora (Nutt) Britton. Fragrant Giant

Hyssop. In coulee just south of Missouri river along Williston-Alexander trail in McKenzie county.

HEDEOMA HISPIDA Pursh. Rough Pennyroyal. On dry stony top of butte near Alexander in McKenzie county.

LYCOPUS LUCIDUS Turcz. Western Water-hoarhound. Occasional along small streams in wet soil.

MENTHA CANADENSIS L. American Wild Mint. Abundant on moist soil along streams and sloughs. Valuable as a flavoring plant and used for the extraction of oil of Peppermint from which the drug Menthol is manufactured.

MONARDA FISTULOSA L. Wild Bergamot. Horse Mint. Along coulees leading back from Missouri river.

SCUTELLARIA GALERICULATA L. Hooded Willow-herb. Marsh Skullcap. On alluvial flats by Missouri river.

STACHYS PALUSTRIS L. Hedge Nettle. Occasional on stony hillsides.

TEUCRIUM OCCIDENTALE A. Gray. Hairy Germander. On alluvial flats by Missouri river.

LENTIBULARIACEAE.

Bladderwort Family.

UTRICULARIA VULGARIS L. Greater Bladderwort. Hooded Water-Milfoil. Pop-weed. Abundant in streams and pools.

LILIACEAE.

Lily Family.

ALLIUM CANADENSE L. Meadow Garlic. Abundant in clay and sandy soil along streams.

LILIUM UMBELLATUM Pursh. Western Red Lily. Occasional on hillsides.

VAGNERA STELLATA Morong. Star-flowered Solomon's Seal. In moist soil on hillsides among dense low shrubs.

YUCCA GLAUCA Nutt. Bear-grass. On dry clay and stony hillsides bordering the Missouri river.

LINACEAE.

Flax Family.

Linum lewisii Pursh. Lewis' Wild Flax. Scattered over hillsides and prairie throughout the area.

Linum rigidum Pursh. Large-flowered Yellow Flax. Common over prairie and hillsides.

Linum sulcatum Riddell. Grooved Yellow Flax. On dry stony hillsides, hilltops and open prairie.

Linum usitatissimum L. Common Flax. Escaped from cultivated fields.

MALVACEAE.

Mallow Family.

Malvastrum coccineum (Pursh) A. Gray. Red False Mallow. Abundant and generally distributed throughout the area. Especially abundant and vigorous where ground has been broken by trails or plows.

MELANTHIACEAE.

Bunch-flower Family.

Zygadenus venenosus S. Wats. Poisonous Zygadenus. Death Camas. Common on hillsides. A dangerous poisonous plant to stock, especially to sheep causing the loss of large numbers in neighboring states and should be guarded against here.

MORACEAE.

Mulberry Family.

Humulus lupulus L. Hop. Common along alluvial flats among thick woods along Missouri river. The abundance and thrifty condition of the wild hops gives promise of the profitable utilization of this land for the production of suitable varieties of cultivated hops.

NAIADACEAE.

Pondweed Family.

Triglochin maritima L. Seaside Arrow Grass. In alkaline sloughs along Little Muddy creek.

TRIGLOCHIN PALUSTRIS L. Marsh Arrow-grass. On wet ground along streams.

NYCTAGINACEAE.

Four-o-clock Family.

ABRONIA FRAGRANS Nutt. White Abronia. Occasional on hillsides and along trails.

OLEACEAE.

Olive Family.

FRAXINUS LANCEOLATA Borck. Green Ash. Common on Missouri river lowlands and occasional along other streams. A hardy timber tree in this region, affording a hard strong brown wood. Its numbers are being seriously reduced here through unwise cutting. Immediate steps should be taken to preserve and extend the present growth and distribution by proper planting and cultivation of this excellent tree.

ONAGRACEAE.

Evening-Primrose Family.

ANOGRA ALBICAULIS (Pursh) Britton. Prairie Evening-Primrose. On hillsides and occasional on open prairie.

ANOGRA PALLIDA (Lindl) Britton. White-stemmed Evening Primrose. On dry stony hillsides and occasional in low moist situations by streams.

CHAMAENERION ANGUSTIFOLIUM (L) Scop. Great or Spiked Willow-herb, Fire Weed. On alluvial flats of the Missouri river among dense growth of small timber.

EPILOBIUM COLORATUM Muhl. Purple-leaved Willow-herb. In shallow water and along moist banks of coulees, streams and sloughs.

EPILOBIUM PANICULATUM Nutt. Panicled Willow-herb. On sandy clay soil in Little Muddy Valley.

GAURA COCCINEA Pursh. Scarlet Gaura. Common on dry stony hillsides and open prairie.

LAVAUXIA TRILOBA (Nutt) Spach. Three-lobed Primrose. Occasional on dry open prairie.

Onagra biennis (L) Scop. Common Evening Primrose. A rank-growing troublesome weed which is becoming common in cultivated fields throughout the area.

Meriolix serrulata (Nutt) Walp. Tooth-leaved Primrose. On dry soil on stony hillsides in deep coulees and along streams.

OROBANCHACEAE.

Broom-rape Family.

Thalesia fasciculata (Nutt) Britton. Clustered or Yellow Cancer-root. Common in dry gravelly or stony situations on hillsides and prairie. A parasite on the roots of other plants.

PAPILIONACEAE.

Pulse or Pea Family.

Aragallus lamberti Greene. Stemless Loco-Weed or Crazyweed. Abundant over the open prairie and hillsides. A poisonous plant which causes the familiar "loco" among stock.

Astragalus adsurgens Pall. Ascending Milk Vetch. Common over prairie and hillsides.

Astragalus pectinatus Dougl. Narrow-leaved Milk Vetch. An abundant legume making a luxuriant growth over open prairie and on stony hillsides.

Glycyrrhiza lepidota Pursh. Wild Liquorice. Abundant throughout the area along streams, coulees and stony hillsides. Also found on the sand dunes along the Missouri.

Homalobus tenellus Pursh. Loose-flowered Vetch. On dry stony hillsides.

Homolobus caespitosus Nutt. Tufted Milk Vetch. Growing abundantly on steep hillsides and scattering over dry prairie.

Kuhnistera candida Kuntze. White Prairie-clover. Common over stony hillsides and open prairie.

Kuhnistera purpurea Mac M. Violet Prairie-clover. Abundant over stony hillsides, hilltops and open stony prairie.

Kuhnistera oligophylla Heller. Occasional on stony hillsides and prairie.

Lotus americanus Bisch. Prairie Birds-foot Trefoil. Abunddant on low alluvial land by the Missouri river, in similar situations

along other streams and coulees and ranging up over stony hillsides. Has possible forage value.

PSORALEA ARGOPHYLLA Pursh. Silver-leaf Psoralea. Very abundant over hillsides and open prairie both on stony and loam soil.

PSORALEA ESCULENTA Pursh. Pomme Blanche, Prairie Apple or Turnip. Indian Bread-root. Common on dry, stony and gravelly hillsides and prairie. The large farinaceous roots were used by the Indians for bread and cooked with corn. A good plant for experimental cultivation.

PSORALEA TENUIFLORA Pursh. Few-flowered Psoralea. Scattered over alluvial flats and sand dune areas along the Missouri river.

THERMOPSIS RHOMBIFOLIA (Nutt) Richards. Prairie Thermopsis. On stony and sandy hillsides and prairie.

VICIA AMERICANA Muhl. American Vetch, Pea Vine. Abundant throughout the area on low alluvial soils bordering streams. The abundance of leguminous plants indicates a virgin soil rich in nitrogen and suggests that food and forage legumes, vetches, peas and beans would yield good returns.

PLANTAGINACEAE.

Plantain Family.

PLANTAGO MAJOR L. Common or Greater Plantain. In moist situations in cuts and along streams.

PLANTAGO PURSHII R&S. Pursh's Plantain. Very abundant on dry, sandy and gravelly situations throughout the area.

POLEMONIACEAE.

Phlox Family.

COLLOMIA LINEARIS Nutt. Narrow-leaved Collomia. Occasional in dry beds of coulees.

PHLOX DOUGLASII Hook. Douglas' Phlox. Occasional on dry sandy soil of prairie.

PHLOX HOODII Richards. Hood's Phlox. Common on dry, stony soil of hillsides and prairie.

POLYGALACEAE.

Milkwort Family.

Polygala alba Nutt. White Milkwort. Abundant on stony hillsides and open prairie. Sometimes sold as a substitute for the dry P. senega L.

POLYGONACEAE.

Buckwheat Family.

Eriogonum flavum Nutt. Yellow Eriogonum. Abundant on very dry stony hillsides and hilltops.

Polygonum aviculare L. Knot-grass. Door-weed. Common along roadsides and waste places. A troublesome weed in lawns and around farm buildings.

Polygonum emersum (Michx.) Britton. Swamp Persicaria. About sloughs and wet places.

Rumex persicarioides L. Golden Dock. On sandy alluvial flats by Missouri river.

Rumex salicifolius Weinm. White Pale or Willow-leaved Dock. Sparsely scattered along Little Muddy creek and adjacent sloughs.

POMACEAE.

Apple Family.

Amelanchier alnifolia Nutt. Northwwestern June-berry. Service-berry. A small shrub growing on dry stony hillsides. A good ornamental shrub which produces an edible berry.

Amelanchier rotundifolia (Michx.) Roem. Round-leaved June-berry. On stony hillsides along cuts and streams.

PRIMULACEAE.

Primrose Family.

Glaux maritima L. Sea Milkwort. Black Saltwort. In wet alkaline soil along streams.

Lysimachia terrestris (L) B.S.P. Bulb-bearing Loosestrife. Common on alluvial flats by Missouri river.

Steironema ciliatum (L) Raf. Fringed Loosestrife. Also common on alluvial flats by Missouri river in moist thickets.

RANUNCULACEAE.

Crowfoot Family.

ANEMONE CANADENSIS L. Canada Anemone. Abundant in moist situations along coulees and banks throughout the area. Ornamental herb.

ANEMONE CYLINDRICA A. Gray. Long-fruited Anemone. Along coulees and shallow cuts.

BATRACHIUM TRICHOPHYLLUM (Choix) Bossch. White Water-Crowfoot. Growing in dense masses in pools and streams.

CLEMATIS LIGUSTICIFOLIA Nutt. Western Virgin's Bower. Among woods on alluvial flats by Missouri river. Of much ornamental worth.

OXYGRAPHIS CYMBALARIA (Pursh) Prantl. Seaside Crowfoot. Along moist banks and in bed of small streams.

PULSATILLA HIRSUTISSIMA (Pursh) Britton. American or Nuttall's Pasque Flower. Occasional on dry stony soil on hillsides and prairie.

RANUNCULUS PENNSYLVANICUS L. Bristly Buttercup. On wet ground by streams.

RANUNCULUS SCLERATUS L. Celery-leaved or Ditch Crowfoot. Along banks of Missouri river.

ROSACEAE.

Rose Family.

ARGENTINA ANSERINA (L.) Rydb. Silver Weed. Wild or Goose Tansy. On moist ground in bed and along the banks of small streams.

CHAMAERHODOS ERECTA Bunge. Abundant on hillsides and hilltops, especially on stony soil.

GEUM CILIATUM Pursh. Long-plumed Purple Avens. On dry stony hillsides.

POTENTILLA BIPINNATIFIDA Dougl. Cut-leaved Cinquefoil. Common in dry coulees on stony hillsides and open prairie.

POTENTILLA RECTA L. Rough-fruited Cinquefoil. On gravel terrace by Little Muddy creek. On moist ground by streams and on dry stony hillsides.

Potentilla monspeliensis L. Rough Cinquefoil. Occasional along coulees in dry soil.

Rosa arkansana Porter. Arkansas Rose. Abundant along coulees, on hillsides and prairie throughout the area.

Rosa carolina L. Swamp Rose. Common on the flood plain of the Missouri river and banks of Little Muddy creek.

RUBIACEAE.

Madder Family.

Galium boreale L. Northern Bedstraw. On stony hillsides and along streams and coulees.

SALICACEAE.

Willow Family.

Populus deltoides Marsh. Cottonwood. Necklace Poplar. Abundant in moist soil of Missouri river lowlands, and scattered occasionally along smaller streams. One of our most valuable native trees for wood, wind-break, shade, shelter, etc. Should thrive throughout the area if properly cultivated.

Salix amygdaloides Anders. Peach-leaved Willow. A good sized tree growing by pools and streams.

Salix balsamifera (Hook) Barratt. Balsam Willow. On lowlands of Missouri river.

Salix cordata Muhl. Heart-leaved Willow. Scattered along edges of streams and pools. A variety of this willow known as vestita, is the diamond willow of the Missouri flats. it makes a quality of fence post which for duration is second only to locust.

Salix fluviatilis Nutt. Sandbar Willow. River-bank Willow. Abundant along streams.

SAXIFRAGACEAE.

Saxifrage Family.

Heuchera hispida Pursh. Rough Heuchera. On dry stony hillsides.

SCROPHULARIACEAE.

Figwort Family.

Orthocarpus luteus Nutt. Yellow Orthocarpus. On dry lowlands and open prairie.

PENTSTEMON GRACILIS Nutt. Slender Beard's-tongue. Common on dry stony hillsides and open prairie throughout the area.

SOLANACEAE.

Potato Family.

SOLANUM TRIFLORUM Nutt. Cut-leaved Nightshade. Occasional on stony hillsides and prairie.

TYPHACEAE.

Cat-tail Family.

TYPHA LATIFOLIA L. Broad-leaved Cat-tail. Occasional along small streams.

UMBELLIFERAE.

Carrot Family.

MUSINEON DIVARICATUM (Pursh) Nutt. Leafy Musineon. Common along Missouri and Little Muddy lowlands.

PEUCEDANUM VILLOSUM Nutt. Hairy Parsley. Abundant along lowlands and occasional over the prairie.

SIUM CICUTAEFOLIUM Gmel. Hemlock Water Parsnip. Abundant along Little Muddy creek and its tributaries. Often mistaken for the poisonous Water Hemlock. (Cicuta maculata L.)

ZIZIA CORDATA (Walt) D. C. Heart-leaved Alexanders. Occasional on stony hillsides.

URTICACEAE.

Nettle Family.

URTICA GRACILIS Ait. Slender Nettle. Abundant on moist ground by streams.

VACCINIACEAE.

Huckleberry Family.

VACCINIUM STAMINEUM L. Deerberry. Growing abundantly on dry open prairie and hillsides.

VIOLACEAE.

Violet Family.

VIOLA OBLIQUA Hill. Meadow or Hooded Blue Violet. On alluvial flats of Missouri river and in moist and shaded situations along banks of streams.

VITACEAE.

Grape Family.

VITIS VULPINA L. Riverside or Sweet-scented Grape. Common among timber along Missouri river lowlands. A good vine for arbor and porch decoration. Affords an edible grape, the juice of which may be used for many purposes. Its presence also suggests the possibility of profitable grape production upon the moist lowlands by the selection and proper cultivation of hardy domestic varieties.

SEED BREEDING AND CROP DISEASE: The Department continues its studies upon these essential lines of interest in farm cropping. As in previous years, general attention is given to the three important crops, wheat, flax and potatoes, though much time is given to the study of disease of other crops, as garden vegetables, trees and the various cereals. In the breeding work, each method of breeding and selection is made use of according as a special method may prove of importance in adding to our knowledge of the influence of plant disease upon the breeding question. It is not the aim of this Department to over-lap the work of the horticultural or farm departments, though in some cases, in order to carry experimental lines to completion it may be necessary to make field demonstrations and even conduct co-operative field experiments with farmers. As an illustration of this feature, when studying the question of wilt resistant flax, it is not primarily the intention of the Department to go into the seed introduction business further than necessary to demonstrate the principle of plant resistance to disease and the modes through which farmers may proceed in the development of seed of similar resistant quality.

The studies upon resistance of immune flax have progressed to a point when it is desirable to find out whether the resistance which is developed in our breeding and selection plots, will be maintained under field conditions in the various parts of the state. With this end in view, last season several strains of resistant seed flax were increased sufficiently to allow us to furnish seed enough for co-operative investigations with farmers. As indicating the importance which the farmers attach to this line of investigation,

it may be said that applications for even small amounts of seed far surpass the amount which the Department will be able to furnish. In all, about one hundred and fifty samples will be sent out during the spring of 1908. These samples will vary in quantity from one-fourth to one peck each. They will be furnished to such farmers as promise to care for them and look upon the work as a definite experiment in which their work is of as much importance as that of the Experiment Station. During the growing season we expect to visit these farmers and observe the results and if the farmers properly save the seed and take records as to the yields at harvest time and return proper reports of the same it will be possible to gain much information regarding the value of this line of investigation. Circular letters of instruction will be sent with each sample of seed. It is known that the seed sent out is practically resistant to the soil disease known as wilt, under the conditions under which we have tried the same here at Fargo. It is not known whether the resistance can be maintained under the farm conditions represented by the various climatic and soil conditions of the state. Herein lies the importance of the co-operation of the farmers.

SOIL STUDIES: In past investigation, this Department has learned that a number of causes of crop depletion arise in soil conditions and our investigations point to the fact that biological conditions play a marked role. With these facts in mind, extensive experiments have been planned and mapped out for future work to test many important biological problems in connection with handling soil. As for example, the relation of soil texture to crop disease; the relation of cropping methods to plant breeding for disease resistance; the method of handling the soil by cultivation and relations of soil fertility as affecting crop resistance to disease, and methods of applying fertilizers as influencing any or all of these problems; the influence of fertilizing elements upon the growth of fungi and bacteria in soil and numerous other bacteriological problems which bear directly upon plant growth. With a view to conducting these experiments, the farm department has kindly assigned to this department new areas of land. This has been mapped and laid off into permanent areas and schedules have been made out which determine beforehand what will be done with each plot for a number of years in advance. It would be premature to make a statement of results observed during this present growing season but many of these are certainly very encouraging when looking towards an understanding of the causes underlying many of our crop troubles.

WEED STUDIES: Our preliminary studies made in previous

years upon weed eradication by means of chemical sprays, elicited much interest in this state and have been followed in other states and countries to such an extent as to prove their worth. Our own farmers have farmed upon such a large plan that they have been loath to take up with a new work of so large proportions as indicated in the possibility of weed spraying. In this state, to accept the principle of eradication of weeds by means of field sprayers means the purchase by single farmers of complicated and expensive machinery. Sprayers which would give satisfaction in farming districts in which the farms are divided into small fields would be utterly unsatisfactory for farmers working upon the broad areas represented in the field culture of North Dakota.

In accordance with your wish, a portion of the growing season of 1907 was set aside for extended field demonstrations with a view of placing before the farmers the efficiency of this work. Seven extended demonstrations were conducted which varied in the extent of areas treated from forty to one hundred acres each, each demonstration being conducted upon two or more farms in a neighborhood upon all the various types of weeds there represented. Careful observations were made upon the effect of solutions upon each of the different cereal crops and upon each of the kinds of weeds. These demonstrations were made not only thus extensive but were so conducted as to constitute further experiments as determining the kinds of substance most desirable to use; the type of machinery most economic and effective; and the atmospheric conditions under which the work may best be undertaken; the time to conduct the work and how best to conduct the operations when undertaken upon extensive field plans. For six weeks, Assistant Professor Pritchard and myself devoted practically our entire time to this type of work. The American Steel & Wire Co., of Chicago, furnished large quantities of iron sulfate free of cost for this work and also the funds for the shipment of machinery. The farmers upon whose farms demonstrations were conducted furnished the teams and labor necessary to do the work. Aside from this, The American Steel & Wire Co. placed a large amount of the prepared iron sulfate at the disposal of this Department to be shipped to any farmers who were prepared to conduct either small or large experiments of their own accord.

On account of the fact that the chemicals and machinery were delayed in shipment, the experiments and demonstrations did not begin as early in the season as necessary in order to give the most satisfactory results. However, these field demonstrations conducted at Mapelton, Grandin, Grand Forks, Arvilla, Grafton, St. Thomas and Bathgate together with our investigations here at the College upon this work allow me to say that I am convinced

that there is proper machinery made by a number of American firms for this work; that field spraying for the eradication of mustard is an unqualified success, and that every weed, except only those of the grass family, which may be directly wet by a water solution can either be killed or controlled by means of chemical sprays without reducing the yield of any of the cereal grains. Indeed, where mustard, for example, is so thick that it cannot be pulled without injury to the standing grain, provided there is a normal stand of wheat, oats, barley or flax, our experiments or demonstrations prove beyond a question that a yield from such crops will be materially increased by spraying, and that that increase will much more than pay for the cost of machinery, labor and chemicals necessary. The Department has published upon this work during the year, five press bulletins, numbers 25 to 29, and has prepared for publication a regular station bulletin upon methods of weed control and eradication. Number 80. This bulletin will be ready for distribution March 1st. Full details of these investigations may be found in these bulletins. One feature, however, is of much importance and should be noted here.

Farmers generally do not seem to be sufficiently impressed with the necessity of procuring for this work proper types of machinery. There are many firms in the country that have developed spraying machinery for other kinds of work which, when adjusted for this field work, prove thoroughly efficient. No mere sprinkling pot or potato sprinkling machine is satisfactory. Farmers should correspond with spraying machinery firms or put themselves in touch with their own local machinery dealers and learn the machine that is necessary for this work. They not only harm themselves but harm others by condemning an agricultural process of which they may be said to know nothing until they have given it a fair trial by using the kinds of machinery and other appliances which experiment has shown to be necessary.

For various sorts of weeds, we have found that chemicals vary as to their effectiveness and have recommended, according to the purpose for which they are used, common salt, iron sulfate, copper sulfate, sodium arsenite. The uses of these different substances are explained in the bulletins. The Department has also issued Press Bulletin No. 23, regarding the mode of developing resistant seed flax.

SEED TESTING: The Department has issued a circular letter with regard to seed testing. The circular explains the purpose of the work. It may be said that the Department is well equipped and ready to make careful examinations of the seeds of different grasses and forage plants sold upon the market with a view of ascertaining the grade of purity and viability of these seeds which

are available to farmers. The work cannot be pushed with great rapidity but each sample as it is received, will be taken in order and carefully tested. The Department will be pleased to receive samples either from seedmen, as indicated in the circular or from farmers who have purchased seed of the seedmen.

The essential feature, so far as the Department is concerned, is that the person sending the seed will send a fair sample and that they will name the firm from whom they procured the seed. This request is made of seedmen as well as farmers. No report will be made of the test unless the persons sending the seeds tell from whom they purchased them. The circular is worded as follows and will be sent to all dealers in agricultural seeds in the state:

"DEAR SIR: For a number of years the Department of Botany of the North Dakota Agricultural Experiment Station has examined and tested for the farmers and seedmen of the state any samples of agricultural seeds which individuals might see fit to submit together with questions as to their viability and purity. No other feature of agriculture is of so great importance as the certainty that seeds to be placed in the ground shall be of high quality as to viability and purity.

"During this work it has become evident, year by year, that the quality of many types of seeds which are sold upon the market, especially those of grasses and forage plants, are becoming of poorer and poorer quality regarding both viability and purity. Many of these seeds are of such a nature that the average farmer and seed merchant is unable to judge of their quality and purity. Practically none of our seed merchants of the state grow any of their own seeds. They are, therefore, wholly at the mercy of the general seed trade and are almost as apt to be deceived in the quality of seeds which are sold to them as are the farmers who are to be the final purchasers.

"We wish to be of as much use to all persons concerned as possible but realize that the methods pursued during the years just past have not fully reached the real source of the trouble. We, therefore, now wish to undertake a more comprehensive study of the character of agricultural seeds which are being sold upon the market. To this end, we intend to institute careful studies upon the points of purity and viability, of those seeds which are most liable to be adulterated and most liable to lose their viability because of improper handling, and ask each seed merchant if he will co-operate in the work, with a view to raising the grade of seed supplied to the farming public of the state.

"We will, therefore, be pleased if you will furnish us with about one-half pound of any of the common grass or forage seeds

which you may have on hand, stating the time of purchase and from whom procured. We especially want samples of the following seeds; white clover, red clover, alfalfa, brome grass, meadow fescue, blue grass, red top, timothy and lawn mixtures. When received these seeds will be tested as to their purity and viability and results reported to you.

"At any time, whenever you receive a consignment of any of these seeds which you have purchased, we will be glad to receive samples for examination with the view of aiding you in determining whether the wholesaler or jobber has given you the seed quality desired by you."

STUDIES ON SEED FORMATION IN CLOVER AND ALFALFA: When this Department first began work in North Dakota, the writer was surprised at the marked fertility shown by red clover in its production of seed both in the first and second crops. At that time there were practically no bumble bees in the state and we made note in our reports of our observations that it did not seem probable that these insects were needed in the fertilization of clover for the production of seed in this state. We have since made a number of small experiments to ascertain if seed would be formed in the absence of bumble bees. We found that this would seem to be true. In 1906, we enclosed large areas of clover by the use of screens of the size approximating six meshes to the inch. Only a few heads of clover produced any seed. This agreed with our experiments of the previous year done on a smaller scale. In 1907, six cages were arranged, covering areas of ground exceeding a square yard. Screens of the following size were used: Twelve meshes to the inch; six meshes to the inch; three meshes to the inch and two meshes to the inch. The studies were made upon white clover, alfalfa and red clover.

Interesting observations were made with regard both to white and red clover. When meshes of the screen were sufficiently fine; that is, below six meshes to the inch, practically no seeds were formed. While the one-third inch meshes and the one-half inch meshes proved sufficient to exclude bumble bees, at least no bumble bees were ever seen in the cages, and there were still a great number of unfertilized heads, there were also heads which were well filled. The cages were not sufficiently watched to determine what other insects, if any, visited them though none other than a few house flies attracted attention. The work with the larger sized meshes would seem to indicate that in some cases red clover is self-fertilized or else fertilized by small insects while the work with the finer meshes would seem to indicate that it is seldom, if ever, self-fertilized. It is possible that wind rustling is a necessary element in this

work and that the screens with the finer meshes largely prevented this.

The details of this work will be retained for summarization after more inclusive and conclusive experiments have been conducted. This season, the seed of the plants which have fertilized in the cages has been saved and will be propagated for study.

Trials of Hemp: A good number of questions come to the Experiment Station every year regarding whether hemp can be grown in this region. I had thought it of particular importance as it possibly might be proved that, in the future, the longer hemp fiber might be mixed to advantage with our poor, short flax fiber in the making rough twine and cordage. I, therefore, procured a number of samples of hemp seed for test. Several samples of small hemp, characteristic of European Russia were brought with me from that country in 1903. I also procured two samples of seed from the best hemp growing regions of Kentucky and a sample of Manchurian hemp seed was received for trial from the Department of Agriculture, Bureau of Seed and Plant Introduction.

The seed brought from old Russia has been grown here each year since 1903. It has always matured both the fiber and the seed. It grows exceedingly short and when planted sufficiently thick to produce a good quality of fiber has a length little, if any, greater than common fiber flax. It is to be doubted if it has any merits for fiber over that crop. The two samples of Kentucky seed produced hemp straw eight to twelve feet high of a beautiful quality and matured it, we believe, sufficiently to make a good quality of fiber before frost came. The plants grew without branching and produced a slender stem in size approximately one-fourth to three-eighths inch in diameter. These Kentucky samples, however, failed to fully mature the seed before frost came, when planted for seed purposes. As the frost came rather earlier than usual and as the seed was planted fully two weeks later than it need have been planted, I have no doubt that the Kentucky hemp may be made to ripen its seed in this region in average years.

The Manchurian seed when planted for seed purposes, matured seed thoroughly before frost. When planted for fiber it produced a growth rather harsher and less fine than the Kentucky hemp and gave a height not to exceed six to eight feet. It is possible that when this type of hemp is given proper culture for fiber purpose that it would be quite desirable for this state. Indeed, the experiments were sufficiently conclusive to show that hemp may be grown to good form for both fiber and seed. Bundles of the best type of these hemps were sent to the Minnesota Hemp

and Fiber Co., of Northfield, Minn., and this company promised to make tests of the fiber quality and percentage produced.

CORRESPONDENCE: The correspondence of the Department continually increases in the range of the questions and in the number. During the year, the direct correspondence has amounted to something over 1,500 letters which may be classified roughly as follows:

General and foreign	448
Plant disease	342
Weeds	220
Grasses	48
Seeds and Seed Testing	111
Herbarium	56
Miscellaneous	320
	1545

This correspondence consumes much of the time of the head of the department as many of the questions asked are of such nature as to actually demand study and investigation before proper answer may be returned. It represents, however, the connecting link between the work of the department and the work of the farmers and for this reason is of utmost importance in increasing the usefulness of the department to the state. Farmers, teachers and others should, therefore, not only feel free to ask questions and send in specimens but should feel it a part of their duty to ask of us information upon those features of plant life and agriculture for which the Station is maintained.

H. L. BOLLEY,
Botanist.

HORTICULTURAL DEPARTMENT

To Director J. H. Worst,

Sir: The work in the horticultural department during the past year has been considerably extended, particularly along the lines of experimentation in forestry planting and fruit growing. Five acres of experimental forest planting have been added to the area already established. The species planted were Scotch pine, Austrian pine, Norway pine, jack pine, bull pine, European Larch, hardy catalpa, Norway maple and black walnut.

While the trees are yet too young to afford sufficient data for general conclusions yet the following points seem established:

First: The bull pine, Austrian pine and European Larch are not difficult to start and are hardy in this latitude, thus making the growing of valuable coniferous trees in North Dakota possible.

Second: It is useless to try and start a plantation of coniferious trees under our conditions with one year or two year seedlings. A three year transplant is the smallest tree that should be used. The rate of growth and ultimate value of the different conifers for this region cannot of course be determined till later.

Eight acres of land were put into shape in 1907 for planting in 1908. The following trees will be planted, so far as the stock can be procured; Norway pine, white spruce, aspen, diamond willow, gray willow, Norway poplar, Carolina poplar, white ash, green ash and cottonwood.

This planting is chiefly for determining the trees best suited for fuel and for posts. The planting of the pines was for timber purposes. A complete record of the trees has been kept up to the present time, the value of which so far is to indicate the cost and relative difficulty of starting each kind of tree, and the size best suited for planting.

The fruit plantations were increased by the addition of one hundred ten plum trees of eleven varieties and of two hundred thirty apple trees of twenty-three different sorts.

These were planted upon alfalfa sod and have made a substantial and satisfactory growth. A considerable number of bush fruits including the later varieties were planted.

The season was unfavorable for raspberries, all varieties of which made a poor start. The currants and gooseberries nearly

all lived. The trial bed of the newer sorts of strawberries was a failure owing to the extremely cold weather in the spring before the plants were rooted.

In September a commercial strawberry bed of one acre was set out with the object of determining the total cost and total income on one acre of berries, grown under average conditions. While strawberry growing at the station has been considered a success, we have never been able to decide exactly what profits may be expected in this locality from this enterprize.

The work of growing seedling apples and plums has been carried forward with satisfactory results. We are gratified to find that aside from the size and quality of the fruit of some of our seedling plums they also seem to keep free from the Exoascus or bladder disease that is so destructive to original wild plums growing at the station.

Complete plans have been prepared during the year for greenhouses to be erected in the spring. These will consist of a house 66x24 for student work, particularly in connection with class instruction, one house 66x18, one part to be devoted to ornamental plants and the other for general propagation, and a third one of the same size for experimental work in plant breeding and plant culture. Some of the work outlined for the past season has been deferred, awaiting the completion of these buildings.

The work done in vegetable gardening will appear in a bulletin now in the course of preparation. It was devoted largely to cultural and variety tests, with improvement, through selection, of sweet corn and tomatoes.

Some planting was done during the year of ornamental plants to determine their suitability for this region and their different uses in park and garden. This line of work should be considerably extended as its results and possibilities are new to most people of the state.

Some time was spent upon insect investigations, particularly those attacking the shade trees and also the wire worm that proved destructive in grain fields in parts of the state.

These regions were visited and information furnished to the press as to the nature of the insects and methods of treatment. The usual correspondence regarding the many kinds of insects sent in for identification was more extended than in most former years.

The inquiries concerning fruit and trees of all kinds, particularly those seen at the Experiment Station, have also been very numerous, showing that the work of the department has aroused very general interest in the various lines of horticulture.

Respectfully submitted,

C. B. WALDRON.

Department of Veterinary Science

J. H. Worst, Director,
Experiment Station,
Agricultural College, N. D.

Sir: Acting upon your recent request, I beg to submit the following brief report on the work done by this department.

After my return from a six months leave of absence, the study on "swamp-fever" in horses was continued. As we experienced some difficulty in obtaining suitable material, we suffered from some delay in getting work under way. One case was obtained, however, and used for clinical and post-mortem observation. In addition we are making some inoculation and feeding experiments with material obtained from this case, and will embody the results of this work in a future report—the work not being sufficiently advanced to warrant any definite conclusions. It is the intention of the department to continue the study of this disease, which, is continually growing in importance, both to our farmers and to our veterinarians.

In the near future, we will also commence some observations on the agglutination method for the diagnosis of glanders, with a view of ultimately using the method in our state work with this disease.

Attention is again called to the great need of a suitable building for the work of this department, as it is almost impossible for this department to do its work under the present disadvantages.

In addition I beg to recommend that certain funds be placed at the disposal of the department in order to enable it to carry on the "swamp-fever" investigation on a larger scale, so as to increase the possibility of reaching some definite conclusion.

Yours respectfully,

L. Van Es.

STATEMENT

The United States Appropriations, 1906-1907.

RECEIPTS.	HATCH FUND	ADAMS FUND
To Receipts from the Treasurer of the United States as per appropriations for fiscal year ended June 30, 1907, under acts of Congress approved March 2, 1887 (Hatch Fund) and March 16, 1906 (Adams Fund	$ 15,000.00	$ 7,000.00
DISBURSEMENTS.		
By salaries	8,248.04	3,646.60
Labor	2,560.04	1,643.10
Publications	2,016.02	
Postage and stationery	150.07	54.37
Freight and express	9.50	103.34
Heat, light, water and power	366.76	
Chemical supplies	56.27	16.10
Seeds, plants & sundry supplies	305.00	158.23
Fertilizers		1.50
Feeding stuffs	185.90	
Library	12.70	4.00
Tools, implements & machinery	20.38	117.90
Furniture and Fixtures	181.10	167.40
Scientific apparatus	109.63	787.46
Live stock	500.00	
Traveling expenses	251.09	
Contingent expenses	15.00	
Buildings and land	12.50	300.00
Total	$ 15,000.00	$ 7,000.00

C. E. NUGENT,
Accountant.